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Annex

SECOND AND FINAL REPORT OF THE UNITED NATIONS TEAM OF EXPERTS APPOINTED BY THE SECRETARY-GENERAL PURSUANT TO SECURITY COUNCIL RESOLUTION 598 (1987), PARAGRAPH 7, PREPARED FOLLOWING A FURTHER VISIT BY THE TEAM TO THE ISLAMIC REPUBLIC OF IRAN TO COMPLETE ITS STUDY OF THE COUNTRY'S RECONSTRUCTION EFFORTS AND NEEDS IN THE WAKE OF THE CONFLICT BETWEEN THE ISLAMIC REPUBLIC OF IRAN AND IRAQ

7 NOVEMBER-1 DECEMBER 1991

Addendum

SECTORAL REPORTS

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A. HOUSING AND HUMAN SETTLEMENTS

Introduction

The task of reconstruction and rehabilitation of the human settlements and housing sector will be vast, since ground battles took place for the most part inside the territory of the Islamic Republic of Iran. The Government reports that about 14,000 square kilometres of Iranian territory along the 1,200 kilometre border of the five western provinces were active theatres of ground conflict and the direct effects of the conflict were spread over a 96,000-square-kilometre area. This western third of the country is the most densely populated part of the Islamic Republic of Iran. The population was rather evenly distributed in a settlement pattern centred on cities ranging in population from 1 million down to 350,000, each city in turn having a hierarchical structure of towns and villages within its area of influence.

The amount of damage to human settlements within those areas that saw ground combat is close to total, while cities beyond the front-lines but within reach of the enemy air weapons suffered varying degrees of damage. In order to replace what has been lost, cities, towns and villages, complete with housing, basic infrastructure, services and facilities, as well as industrial and commercial establishments, need to be reconstructed or rehabilitated to accommodate the 1.2 million displaced population in settlements spanning the entire 14,000 km^2 area.

The Iranian Government has assigned the highest priority to the reconstruction and renovation of the cities, town and villages in the war-affected provinces. Apart from facilitating the resettlement of the displaced population, the major investment required to reconstruct the housing sector will contribute in a direct manner to the reactivation of productive capacity and thus the economy of the affected areas and of the country in general.

The priorities set by the Government for the human settlements and housing sector are:

(a) Reconstruction of residential and commercial units;

(b) Creation of productive employment for the people in agriculture and small industries;

(c) Provision of fuel, water, sanitation, electricity, roads and telecommunications facilities;

(d) Reconstruction of factories that produce building materials;

(e) Reconstruction of historic monuments and the preservation of certain symbols of war.

In order to ensure effective popular participation in the reconstruction process, the Government has decreed the following administrative policy:

(a) The owners are responsible for the reconstruction of their own units;

(b) Design and selection of materials is left to the discretion of the owners;

(c) Government support will concentrate on those tasks that individuals can not effectively carry out by themselves or that would be too costly, such as levelling of ground and clearance of debris;

(d) The Government will prepare physical development plans and provide technical support and supervision for the construction efforts;

(e) Support services will be strengthened with respect to available equipment, facilities and technical resources and with respect to their accessibility to war-damaged areas;

(f) The Government will provide for the transport of building materials to construction sites;

(g) The participation of voluntary assistance from other provinces will be encouraged and facilitated;

(h) The resources of the army and the Revolutionary Guard Corps will be employed in the construction of infrastructure and government buildings.

On the financial side, the Government is providing partial compensation for losses and damages sustained by private individuals in the form of grants. Low-cost bank loans have also been made available for the construction and repair of commercial and residential units to cover expenses beyond the compensation grants.

1. Demographic impact of the war

Displaced population

According to government sources, at the peak of hostilities there were over 2 million displaced persons as result of the conflict. The impact of the displaced population in host cities has been considerable. The city of Mahshahr, for example, more than doubled in population during the period 1980-1990 owing, in great part, to an influx of displaced people from cities and towns in the occupied areas. During this same period other cities in the five border provinces, but beyond occupied areas, also showed high indices of population growth owing to the influx of displaced people.

The impact of such demographic movements on human settlements is twofold. On the one hand, the infrastructure, buildings and other facilities of an urban area quickly deteriorate if not regularly maintained. For example, a sewerage system that is not constantly used and maintained becomes clogged with sediment, rendering it useless and difficult to rehabilitate. This has apparently been the case in most of the deserted settlements in the occupied areas. On the other hand, the influx of great numbers of people over a short period of time places an inordinate burden on the social and physical infrastructure of a city. For example, the city of Ahwaz had adequate infrastructure for a population of slightly over half a million in 1980; the city has now close to 1 million inhabitants, and a sizeable portion of the additional population is attributed to the influx of displaced people. As the infrastructure was not designed and built for this level of population, the existing systems have not been able to carry the burden, with a consequent deterioration in services. Moreover, the city's revenues have not grown commensurate with the increase in population since the displaced people are by and large not involved in economic activity that produces revenues for the city.

2. Human settlements

The striking impact of the war on the pattern of human settlement in the Islamic Republic of Iran can be seen from table A.1, which presents population levels for the five border provinces and selected municipalities and cities for the years 1976 (official census) and estimates for 1980 and 1986 and 1990 (official census). The cities marked with an asterisk are outside the areas occupied by Iraq.

Table A.1

Population changes of selected cities
(1976, 1980, 1986 and 1990)

Place	Population			
	1976	1980	1986	1990
Islamic Republic of Iran	33 708 744	39 291 000	49 445 010	56 882 000
Khuzestan Province	2 187 118	2 373 000	2 681 978	3 292 447
* Ahwaz (city)	496 468	569 708	861 970	989 130
Abadan (municipality)	376 911	432 514	0	27 000
Abadan (city)	294 068	337 449	0	19 000
Khorramshahr (municipality)	225 633	258 907	2 098	73 000
Khorramshahr (city)	140 490	166 858	0	6 000
* Mahshahr (city)	89 326	102 503	232 642	266 962
* Dasht Azadegan (city)	100 519	115 348	75 272	88 000
Bostan (city)	6 884	7 900	0	6 000
Susan-Guerd (city)	17 428	20 000	22 776	34 000
Howeyzeh (city)	6 012	6 900	2 246	12 000
* Dezful (city)	303 292	348 034	365 695	419 643
Bakhtaran Province	1 030 714	1 186 000	1 462 965	1 683 000
* Bakhtaran (city)	568 963	652 898	862 378	989 598
Qasr-e-Shirin (municipality)	56 000	62 000	0	8 000
Qasr-e-Shirin (city)	23 000	28 000	0	0
Sar-e-Pol-Zahab (municipality)	49 242	53 000	0	31 000
Sar-e-Pol-Zahab (city)	28 765	25 000	0	6 000
Guilan-e-Gharb (municipality)	45 202	24 000	0	65 000
Guilan-e-Gharb (city)	14 793	9 000	0	12 000
Ilam Province	246 024	294 000	382 091	456 000
Mehran (municipality)	44 351	53 000	29 716	32 321
Mehran (city)	12 133	14 500	0	0
Dehloran (municipality)	51 045	61 000	1 988	21 782
Dehloran (city)	8 786	10 500	0	3 000
Musiyan (municipality)	4 183	5 000	0	0
Kordestan Province	782 440	889 500	1 078 415	1 226 000
Azarbayjan Province	1 407 604	1 610 500	1 971 677	2 256 000

Source: Reconstruction headquarters.

Note: The term city refers to the entity under the city government while the term municipality encompasses the larger urban area.

3. Impact on urban areas

According to reports published by the Government, 50 cities and towns and close to 4,000 villages have suffered varying degrees of damage and many total destruction. The cities of Qasr-e-Shirin, Musiyan, Howeyzeh and Sumar, among others, have been totally destroyed. There is little or nothing above or below ground that can be salvaged or rehabilitated. Other cities such as Khorramshahr, Abadan, Bostan, Susan-Guerd, Naft Shahr and Sar-e-Pol-Zahab have sustained considerable damage ranging from 60 to almost 100 per cent. Many other cities in the country suffered varying degrees of damage. For example, 150 missiles exploded in Tehran alone, the majority during the "war of the cities". Dezful was also shelled by artillery fire and missiles, leaving the city about 50 per cent destroyed.

As an illustration of the extent of devastation the Government provided the following estimates of destruction.

Within the occupied areas

Urban settlements in occupied areas suffered major devastation having been the theatres of battles during the hostilities. They are reported to have been subjected to artillery and other forms of ground fire and explosive charges, aerial bombings and missile attacks and, in some cases, systematic destruction by enemy forces. In addition to the destruction of housing, commercial, government (schools, hospitals, clinics, sports facilities, etc.) and industrial buildings, the infrastructure (water, sewerage, streets) suffered significantly from three sources: (a) collateral damage from the destruction of buildings; (b) heavy war equipment such as tanks circulating in the streets; and (c) lack of maintenance.

The economic viability of these cities was also ruined since the agriculture, industry, services and facilities that supported them were damaged or destroyed. As a consequence, the population in this area has decreased significantly. Most settlements were abandoned at least temporarily during the conflict and municipal governments ceased to function.

Outside the occupied areas

Urban settlements in non-occupied areas, which were nevertheless subject to aerial and missile bombardment, did not suffer total devastation but only partial destruction in varying degrees. In these cases the infrastructure suffered at most occasional damage while only buildings and structures directly hit were significantly affected. During the course of the war, this type of damage added up to a considerable level in some cities. There were also significant demographic changes in the cities closer to the war front. At times, the cities were virtually abandoned by their population, leading to considerable decay in their infrastructure on account of neglect and lack of maintenance; at other times, the great influx of refugees from the war zone led to overdemand for municipal services, causing strain and wear in the various systems.

4. Impact of the conflict on rural towns and villages

Within the occupied areas

Rural settlements in occupied areas suffered from much the same sources as the cities and towns. Because a large number of buildings had been constructed from unbaked mud bricks, some villages which were totally destroyed are quickly reverting to a natural state, leaving few traces of the previous habitation. The destruction of irrigation systems and damage to agricultural and pasture land has totally eliminated the economic base of most of these communities. Those towns and villages that did not suffer directly from the hostilities but were abandoned for safety reasons have also decayed because of lack of maintenance and require rehabilitation.

Outside the occupied areas

Rural settlements in non-occupied areas were only occasionally subject to direct damage from the hostilities, but the destruction of agricultural and pasture land and disruption of irrigation systems adversely affected their existence. Houses that had been abandoned even temporarily by their inhabitants also decayed and now require some rehabilitation.

5. Plans for the reconstruction and rehabilitation of human settlements affected by the war

Urban areas

The reconstruction of settlements ravaged by the conflict necessitates the preparation of appropriate plans. For the larger cities within the occupied areas, plans are being prepared in phases so that reconstruction can commence without having to wait for the complete final plan to be approved. To date reconstruction plans for the following cities have been either totally or partially completed: Khorramshahr, Dehloran, Mehran, Musian, Qasr-e-Shirin, Sar-e-Pol-Zahab, Guilan-e-Gharb, Arvand Kenar, Rufiyeh and Bostan. Plans for Naft Shahr and Sumar have not yet been started since these cities were returned to Iranian control only recently, and clearance of mines and other security operations have yet to be completed.

Rural areas

To date the following three rural reconstruction and development plans have been completed: Abadan Island (rural areas), Dash-e-Azadegan (first phase) and Dehloran. Work is under way in the preparation of the following five physical reconstruction and development plans: Dash-e-Azadegan (second phase), Mehran, Khorramshahr (rural areas), Minu Island (rural areas), and Manuhi District (Abadan Island, subset of overall plan already completed).

All the rural plans completed to date as well as those under preparation are in the southern part of the zone that was occupied by Iraq. The reasons for this are that: (a) portions of the central area have only recently fully reverted to the Islamic Republic of Iran; (b) the land has not all been cleared of mines and other unexploded ordnance; and, (c) only a small percentage of the population has returned and, in several instances, local authorities are only now ready to initiate reconstruction.

6. Housing

Loss of shelter is the most widespread physical consequence of the conflict. The entire housing stock was destroyed in many villages, and in several small cities. Moreover, the loss of housing stock was not limited only to settlements within the area subjected to ground combat. Significant numbers of dwelling units were damaged or destroyed by aerial bombing and missile attacks. The Government estimates that 130,611 housing units were totally destroyed and 190,777 damaged as a direct consequence of the war.

Urban housing

The mission ascertained that few residential or commercial structures in settlements within the areas occupied by enemy troops remained intact. Structures had suffered damage either as result of fire power during the conflict or had been demolished for tactical reasons. In the few instances where buildings had escaped harm from fire power or demolition they had been pillaged of all removable items. In major cities, such as Khorramshahr, the loss of housing stock was very substantial. Smaller cities or towns along the border area suffered even more drastic destruction. In the cities of Dehloran, Mehran and Qasr-e-Shirin, for example, the loss of housing stock was total.

Cities outside the occupied areas also suffered varying degrees of damage to their housing stock as a result of missiles and aerial bombardment. For example, in Tehran, 283 housing units were reported to have been destroyed and an additional 1,212 damaged by missile attacks.

Rural housing

The magnitude of damage to villages in the five border provinces was also very high. Over 30 per cent of the villages in these provinces were damaged, many beyond repair. In some villages the destruction was so great that, apart from debris, there was little evidence that there had once been a settlement on these sites. The mission visited the village of Islamiyeh which had become a military camp that changed hands several times during the conflict. Nothing of the village remains except a few signs of building foundations and some construction rubble.

According to government estimates, 1,244 villages were completely destroyed and 1,417 villages suffered damages. In terms of housing units, it is estimated that 76,390 rural dwellings were lost. From field visits, the mission could determine that destruction of rural settlements was very extensive in the area from Dehloran up to Qasr-e-Shirin. Most of the destruction observed in this area appeared to be the result of direct military activity. Immediately to the south of this area, around Rafei, part of the destruction appears to have been the result of flooding, which was said to have been induced for tactical reasons. Further south, in Minu and Abadan islands the damage to rural housing seems to result from deterioration as a consequence of the abandonment of dwellings over prolonged periods. As the prevailing construction material in these areas is earth, structures tended to deteriorate more for lack of maintenance. Their repair is not as practical as if they had been constructed of more durable materials such as baked bricks or concrete. For this reason, many structures that are still standing will have to be replaced. In areas beyond the direct theatre of ground war rural housing suffered relatively little since air attacks were concentrated generally on cities.

Commercial buildings

In addition to the massive loss in housing stock, there was a corresponding loss of commercial buildings. It is estimated by the Government that in the areas that saw ground action alone, 13,140 commercial units were destroyed or damaged during the conflict. Beyond the immediate war front, there was also loss of commercial units, most the result of bombing and missile attacks. The Government estimates losses of commercial units in the country at 20,513 units totally destroyed and a further 25,918 units damaged.

Reconstruction needs

The Government has informed the mission that it will make compensation payments for war-related housing losses to up to 117,635 households. In order to encourage and attract displaced families back to their former houses in the war-affected provinces, the Government has decided to assist in the rebuilding and in the upgrading of dwellings by providing funds for rebuilding to a standard surface per family of 120 square metres. This would amount to the rebuilding or rehabilitation of a total of 14 million square metres. In addition, there is a need to build 73,600 housing units as starter homes for new families within the population of the war-affected areas who, because of the war, were not able to build their own houses. Such families will require an additional 8.8 million square metres of housing construction but, of this total, the Government is prepared to cover 40 per cent of the area built for each dwelling. Thus, the total housing area to be constructed at government expense is equal to 17.52 million square metres. The Government estimates the average cost of such construction at 100,000 rials per square metre, which brings the total cost of reconstruction housing in both urban and rural areas to Rls 1,752,000 million.

In terms of commercial space, the Government estimates that 13,140 units will have to be rebuilt or rehabilitated. The Government will provide grants for 15 square metres of construction per commercial unit or 0.2 million square metres of space. Estimating the average cost at the same rate of Rls 100,000 per square metre, the total cost of commercial reconstruction would be Rls 20,000 million.

The Government informed the mission that the total area reconstructed up to the present, including urban and rural housing, commercial units and government buildings, amounts to about 2 million square metres. About half of the total building area reconstructed to date is in the form of rural housing. In urban areas, where housing losses were more extensive and severe, reconstruction has lagged behind proportionately because of the greater expense and difficulties involved in urban reconstruction.

7. Infrastructure

A. Water, sewerage and waste disposal

Water and sewerage systems in urban areas within the theatre of ground combat suffered mainly from collateral damage and neglect. Abadan City is the most striking example of the loss of water and sewerage systems on account of lack of maintenance during the long abandonment of the city. The networks have become silted up and clogged and pumping stations have fallen in disrepair. In cities such as Khorramshahr and Qasr-e-Shirin, in addition to deterioration brought about by abandonment, there was considerable collateral damage caused by destruction of buildings, heavy military vehicle traffic on the streets, which caused considerable damage to pipes underground, and damage from bombing. In Qasr-e-Shirin the mission also saw signs of explosive charges having been detonated in manholes. Most water-treatment plants and pumping stations suffered damage. While rural areas have less infrastructure, the mission was told that most water-supply systems had been damaged during the conflict. The mission had occasion to observe such damage to water supply systems in a number of settlements.

The lack of adequate water and sewerage systems in the larger cities such as Khorramshahr and Abadan is causing some health concerns and is militating against the return of the displaced population to the cities where these problems are being encountered. In rural areas, extensive reconstruction will be required to enable the populations to have access to potable water.

Another major problem engendered by the conflict is the collection, removal and final disposal of waste, scrap and debris. In urban areas the clearing of the debris from damaged and destroyed buildings is well under way, but considerable work still remains to be done. Under ideal conditions some of the debris from buildings could be utilized in some other construction projects (i.e. protective sea walls), but this has been difficult to achieve within a distance that would make the exercise economically viable. The collection and disposal of other wastes, some of which may be toxic, is yet a

further complication of the clean-up of the war-affected area. The problems of studying and surveying adequate sanitary landfill sites and other forms of disposal were stressed by the Government. By contrast, the problem of debris from buildings is much less critical in rural areas. This is due in part to the nature of construction materials used in the villages (mostly earth construction), and the much lower settlement densities and smaller structures. On the other hand, the salvage and recycling of spent war equipment represents a larger problem, because it is spread over much larger areas.

Electricity

The re-establishment of electric power is a prerequisite for the return of displaced populations to the reconstructed cities and towns. The massive destruction suffered in the electric power sector and specific progress in its rehabilitation are elaborated in section F: Electric power.

8. Social services

Nature and extent of damage to services

The Government has indicated to the mission that 22.2 million square metres of public buildings need to be constructed or rehabilitated, in addition to the residential and commercial construction noted earlier. At the Government's stated average cost of Rls 100,000 per square metre, the cost of such reconstruction would amount to Rls 2,200,000 million. Detailed descriptions of the damage suffered by educational and health facilities are provided in the relevant sections of the present report.

Postal services, which are vital to the fabric of social life in a community, were greatly affected by the conflict. The Government has informed the mission that 64 post office buildings were either destroyed or damaged. The total area to be rebuilt is 17,378 square metres, of which 8,807 square metres have already been rebuilt or rehabilitated. These figures include 31 completed projects, 22 under construction and 9 to be started. It should be noted that the post office in Khorramshahr covered 4,300 square metres, or about 25 per cent of the total area to be reconstructed. Work on this project has started.

9. Observations

The task of reconstruction and rehabilitation in the human settlements and housing sector is vast. The amount of damage to human settlements within those areas that witnessed ground combat is close to total, while cities outside the direct war zone suffered varying degrees of damage. Reconstruction of the entire settlement system within the affected area is now being undertaken in order to restore the industrial, extractive and agricultural capacity of the region and to facilitate the return of over

1.2 million displaced people. Considering the degree of destruction to settlements, the Government is giving highest priority to their reconstruction.

The mission believes that the considerable length of time which the displaced people have spent away from their former towns and villages could present complications to the resettlement programme. Some people may find their former homes strange to them; many may have formed families with partners from other areas, and children born since the displacement will need to adjust to what for them will be a new place.

Investment in both public and private construction can be an important element in stimulating the economy, since the construction industry, which is primarily private in the Islamic Republic of Iran, requires mostly internal resources and is labour-intensive. Such reconstruction requires the prior creation or recreation of adequate infrastructure. This is being done as a first priority.

In the mission's view, changes to the environment brought about by the conflict should be carefully assessed in order that in reconstructing human settlements the returning population is not placed in any danger from the long-term effects of contamination. Furthermore, the carrying capacity of some areas, in terms of production and their ability to sustain former activities, may have been altered. In such cases, it is important to ensure that people do not return to land that can no longer sustain them. It should also be pointed out that, on account of the highly seismic nature of the country, all reconstruction efforts should integrate earthquake mitigation considerations. In fact, the building stock in the Islamic Republic of Iran is quite vulnerable to seismic events. This was amply demonstrated in the Manjil earthquake of 1990, where extensive failure of buildings caused over 25,000 deaths. Since most of the war-affected area is also earthquake-prone, it would be advisable that the level of resistance to seismic forces be increased in all new construction and that urban plans take potential seismic disasters into consideration.

10. International cooperation needs

Materials and equipment

In discussing international cooperation needs in the field of human settlements, it is necessary to keep in mind that the Islamic Republic of Iran is reconstructing not only from a long and particularly destructive war, but also from a recent earthquake considered to one of the major natural disasters of the past 25 years. To the numbers of dwelling units that must be rebuilt on account of the war, there must be added 200,000 units destroyed by the earthquake. There were also public buildings, schools, hospitals and infrastructure lost to the seismic disaster.

The mission is of the view that, for the reconstruction of human settlements, the Islamic Republic of Iran, is in need primarily of construction equipment since much such equipment was lost during the war. In addition, there are shortages of building materials, particularly cement and iron. Most, if not all, of the shortfall of other building materials should be made up through the establishment of local building materials industries. International cooperation in setting up building materials industries, particularly ones that can utilize local raw materials, would benefit the reconstruction efforts. Moreover, the task of demolition and removal of debris will add from 25 to 40 per cent of the cost of urban reconstruction. This estimate will vary according to the size of the building, the type of construction, the condition of the building and the method of debris disposal (including distance from the site).

11. Professional requirements

The Islamic Republic of Iran possesses a well qualified body of professionals in the fields related to the physical reconstruction and rehabilitation of war-devastated areas such as engineering, architecture and urban and rural planning. The existing national capacity provides a good base to utilize specialized expertise to augment know-how already available within the country. The particular areas of expertise that would be beneficial to the reconstruction effort include development of building materials and improvements to local construction methods.

B. PETROLEUM INDUSTRY

Introduction

The economy of the Islamic Republic of Iran is heavily dependent upon the production and export of oil for the generation of both domestic employment and income and the foreign exchange needed to buy imported goods. The petroleum industry has, for the purposes of the present report, been subdivided into three closely related but distinct parts: oil and gas production; refining; and petrochemicals.

Table B.1 summarizes reconstruction cost for the three sub-divisions of the petroleum sector.

Table B.1

Subdivision	Expenditure to date (millions)		Planned expenditure (millions)	
	Rls	US$	Rls	US$
Production	67 000	859	728 500	18 140
Refining	19 034	357	42 298	793
Petrochemicals	48 850	915	108 556	2 033
Total	134 884	2 131	879 354	20 966

1. Oil and gas production

The Islamic Republic of Iran's estimated proven petroleum reserves of 93 billion barrels are among the world's largest. However, its present production rate is 3 million barrels per day (b.p.d.), just half its historical peak production rate of approximately 6 million b.p.d. attained in 1976, of which 5.5 million b.p.d. were exported and 0.5 million b.p.d. used domestically as feedstock for its refineries. Similarly, as contrasted with its Organization of Petroleum Exporting Countries (OPEC) quota of 3.5 million b.p.d., the Islamic Republic of Iran's current export rate is but 1.9 million b.p.d. This gap between potential and actual output, and thus exports, arises from the damage inflicted on the country's oil production capacity during the conflict.

The Islamic Republic of Iran is currently producing and exporting at the maximum of its reduced capacity. Of its over 618 wells, 1/ only 360 can be operated without destroying the various reservoirs. Gas is being flared at a

rate of about 1.26 billion cubic feet per day (million mcf/d), the energy equivalent of 200,000 b.p.d. 2/ Much of this gas could be reinjected into the reservoirs in order to maintain pressure and the remainder could be used to produce methanol. However, compressors, turbines, gas-treating production facilities and equipment necessary to implement such an efficiency-raising reconstruction operation are not available because of the country's shortage of hard currency.

Direct damages

General

The problems associated with maintaining, repairing, rebuilding, relocation and reconstruction of equipment, pipelines, pump/compressor stations and production facilities during war time and under attack require a magnitude of effort that is enormous.

The areas of oil production that sustained damage during the conflict have been classified by the National Iranian Oil Company (NIOC), which has jurisdiction over all oil-production and export operations in the country, into three regions: south, north and offshore, which are discussed in turn below.

2. South production zone

The south fields zone is the main onshore oil production area in the Islamic Republic of Iran and consists of five fields: Ahwaz, Aghajari, Gach Saran, Masjid-e-Suleiman and Kharg Island. Most of the oil production in the south fields (3 million b.p.d.) is pumped to Kharg Island for export via the T-jetty or the Sea Island loading facilities there. The remainder of approximately 200,000 b.p.d. is pumped to the Abadan refinery, the products of which are then pumped north for domestic consumption. A total of 50 facilities were attacked repeatedly during the war. The mission visited 18 of these facilities and performed helicopter fly-overs on a further two facilities. The damage observed by the mission was generally severe, as expected given the number of attacks.

The damage and destruction inflicted cover every aspect of permanent oil/gas high-volume and high-pressure production operations. These included, but are not limited to, the following: production facilities, oil wells, natural gas liquids (NGL) plants, pump/compressor stations, pipelines, desalting plants, control rooms, desulphurization units, manifolds, storage tanks, gas reinjection plants, loading terminals, housing, offices, warehouses/stores, hospitals, schools, power plants, machine shops, vehicles, telecommunication systems, workshops, water/sewerage systems and aircraft.

The mission was informed during its visit to the Abadan Refinery that of the Refinery's crude storage capacity of 20 million barrels, 15 million barrels were completely destroyed (over 100 storage tanks). Most of the tanks are still at their original location in a melt-down condition (caused by the

heat of the fires); it is estimated that the scrap steel they represent amounts to about 2 million tons.

Kharg Island also warrants special mention because of its unique role in the export of Iranian crude oil and the devastation it incurred during the war. It was attacked almost on a daily basis throughout the conflict. Before the war, Kharg Island was capable of off-loading 14 million b.p.d., utilizing its 14 berthing facilities consisting of 10 berths at its T-jetty and 4 at Sea Island. Its off-loading capability is now about 2 million b.p.d. The east and west terminals are still 75 per cent damaged while the trestle (pier) portion of the T-jetty (east) has been reconstructed to about 90 per cent of its pre-war condition. The mission was informed by NIOC that a contract has recently been awarded to a French company for US$ 225 million to reconstruct not only the north and south sections of the T-jetty terminal but also the offshore Sea Island terminal on the west side of Kharg Island. The Island had a pre-war crude oil storage capacity of 22 million barrels in 39 tanks. Its storage capacity is currently 10 million barrels because 21 tanks were completely destroyed by fires occasioned by the attacks. NIOC informed the mission that a contract has recently been awarded to a Korean company to build five 1-million-barrel tanks and one 500,000-barrel tank as part of the reconstruction programme for Kharg Island.

The mission has been informed that the total cost incurred for reconstruction to date in the south fields area amounts to $500 million and Rls 30,000 million, while the remaining cost of reconstruction to return the facilities to pre-war standards is estimated at $12,000 million and Rls 640,000 million. The mission notes that these estimates include the cost of updating technology which is a decade or more out-of-date. It further notes that these estimates include the cost of replacing compressor stations and implanting treating facilities for a gas reinjection programme, neither of which, in the mission's view, should be included in an accounting of strictly reconstruction costs.

3. North production zone

The prime function of this zone is to pump northward for domestic use both petroleum products from the Abadan Refinery and crude from the Marun oil production facilities. Along the Abadan route, crude oil is also picked up at Ahwaz for transshipment to the Tehran Refinery for processing; the Marun route runs to the Esfahan Refinery. A total of 23 facilities were attacked repeatedly during the war. The mission was able to visit five facilities by ground and four facilities by helicopter fly-overs along the two pumping routes. The damage observed was generally severe and in most cases proportionate to the number of attacks.

Pumping stations used in the north fields area consist of the pumps and drives (gas/steam turbines, electric motors or diesel/gas engines), inlet/discharge manifolds, associated piping, boilers, power plants, fuel storage tanks, electrical substations together with switch gear and transformers, pig traps and launches in addition to control rooms and

miscellaneous buildings for stores, workshops, offices, etc. To reactivate such a unit after bombing damage requires not only an extensive reconstruction effort but also (primarily) replacement of damaged or destroyed operating equipment. However, a bottleneck is created by the fact that the high volumetric capacities and pumping pressures required necessitate equipment that can provide sufficient horsepower and strength to withstand the pressure, all of which is costly and must be imported. When such equipment is available, the time necessary to get back on stream is rather short (a few weeks or at most a couple of months), as compared to production and NGL facilities, which normally require several months.

After several attacks, pipelines along the northbound Abadan pumping route were rerouted and buried at two major areas during their reconstruction because of their vulnerability to any future attacks. At most stations, the reconstruction efforts required that most piping, wiring, pig traps and launches as well as manifolds, some equipment and control rooms, electrical substations, etc. be buried or installed underground so as to prevent damage from future attacks. Surface equipment was protected by installing sand-filled reinforced concrete blocks around the equipment. All of these protective measures were costly and time-consuming. Such precautions were also implemented in the south zone.

The mission visited the Naftshahr production facility on the border with Iraq because of the unique circumstances it went through. This entire facility, consisting of oil/gas separators, pump compressor stations, gathering systems, support equipment, piping, etc., was reported to have been completely dismantled and shipped across the border. The Government is committed to rebuilding this facility to its former capacity of 30,000 b.p.d., and reconstruction work has already commenced. When the facility is completed, the crude will be pumped to the refinery at Bakhtaran, which the mission also visited. This refinery was shut down for over three years during the war because it underwent severe attacks. It was originally designed for 15,000 b.p.d. but has been reconstructed to handle 30,000 b.p.d.

The mission has been advised that the total cost incurred for reconstruction in the north fields area to date amounts to $9 million and Rls 20,000 million, while the remaining cost of reconstruction to return the facilities to pre-war standards is estimated at $140 million and Rls 18,500 million. In the mission's view, these estimates are generous, as the main pumping equipment and drives have already been replaced and are included in the cost of reconstruction to date.

4. Offshore production zone

The sole function of this zone is to produce oil for export. It is divided into five areas of production: Kharg Island (four fields), Pazargad Barge (one field), Bahregan Oil Centre (three fields), Lavan Island (three fields) and Sirri Island (two fields). The mission was able to visit three facilities (the Kharg Island onshore production facilities, the Bahregan Oil Centre production facilities, and the Abouzar offshore production/well

protector platform) and to perform helicopter fly-over investigations at four other locations (two drilling/well protector platforms producing from the Abouzar offshore field, well protector platforms producing from the Darius offshore field and the Pazargad Barge/single-point mooring buoy and well protectors producing from the Cyrus field).

The pre-war crude oil production from the five areas was 870,000 b.p.d. Its current production is 242,000 b.p.d., a reflection of the damage inflicted upon the offshore production facilities. Of the 80 installations struck in the whole offshore production area, 32 were completely destroyed.

The Iranian offshore operation includes 139 platforms and 332 wells and involves all aspects of oilfield operations. It is a very costly and complex operation. The mission was advised that over $2,500 million was expended in developing this offshore petroleum operation, most of which is completely destroyed or damaged.

The mission has been advised that the total cost incurred for reconstruction in the offshore production zone to date amounts to $350 million or Rls 17,000 million, while the remaining cost of reconstruction to return the facilities to pre-war standards is estimated by the Government at $6,000 million or Rls 70,000 million. Reconstruction of offshore facilities requires very specialized equipment and marine support vessels. The mission was advised that, because of the war and the vulnerability of all marine vessels and activities, very little offshore reconstruction or any other work has been done except for plugging with cement as many wells as could be done under the circumstances, to protect them from further damage. The mission therefore considers that the damage and destruction inflicted is currently about the same as incurred during the war (50-60 per cent). In the mission's view, therefore, these estimates are generous, even when the cost of marine support facilities is included.

5. Reconstruction costs

Table B.2 below summarizes the information provided by the Government on reconstruction costs for the four production areas in the country, based on expenses incurred during the war plus those incurred since the cease-fire and those expected to be incurred in the future.

Table B.2. Reconstruction costs by major production area

(In millions of rials and dollars)

Area	To date		Planned		Total	
	Rls	US$	Rls	US$	Rls	US$
South	30 000	500	640 000	12 000	670 000	12 500
North	20 000	9	18 500	140	38 500	149
Offshore	17 000	350	70 000	6 000	87 000	6 350
Total	67 000	859	728 500	18 140	795 500	18 999

The total cost of reconstruction, both past and future, according to the Government's estimate, is thus Rls 795,500 million or $18,999 million. The worksheet underlying this table has been provided to the mission and is on file for the record.

6. Refining

This section of the report deals with the refining subsector, sometimes referred to, together with petrochemical activities, as "downstream" operations. There are seven refineries in the Islamic Republic of Iran, ranging from Abadan, once the world's largest, to Lavan, a small topping plant on an island off the southern coast. Before the outbreak of the war these seven plants were processing close to 900,000 barrels of crude oil per day, enough not only to supply its domestic needs but also to enjoy the benefits of a considerable export market.

Figure B.1

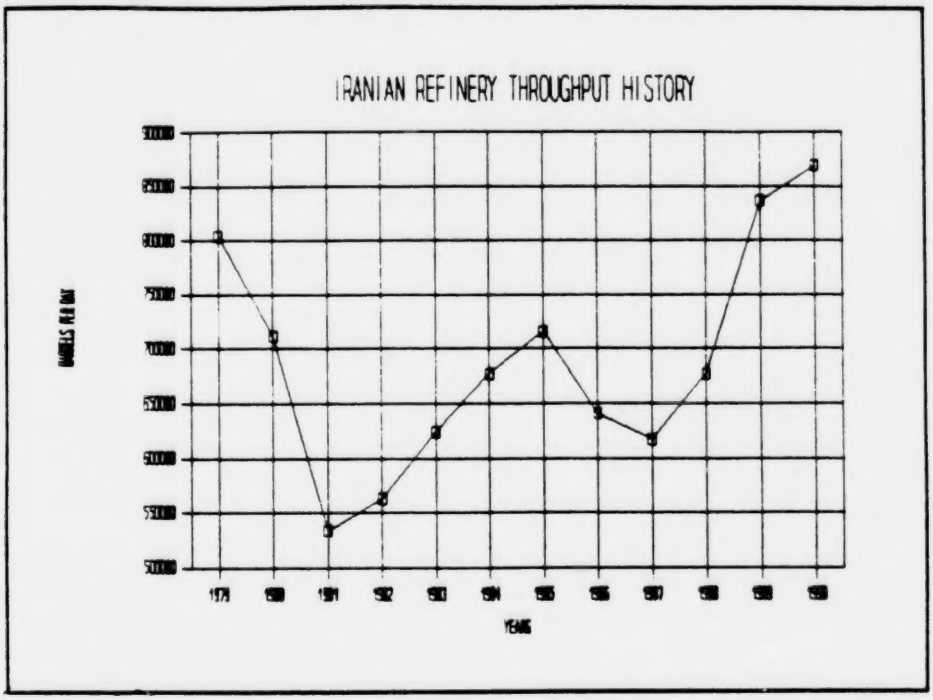


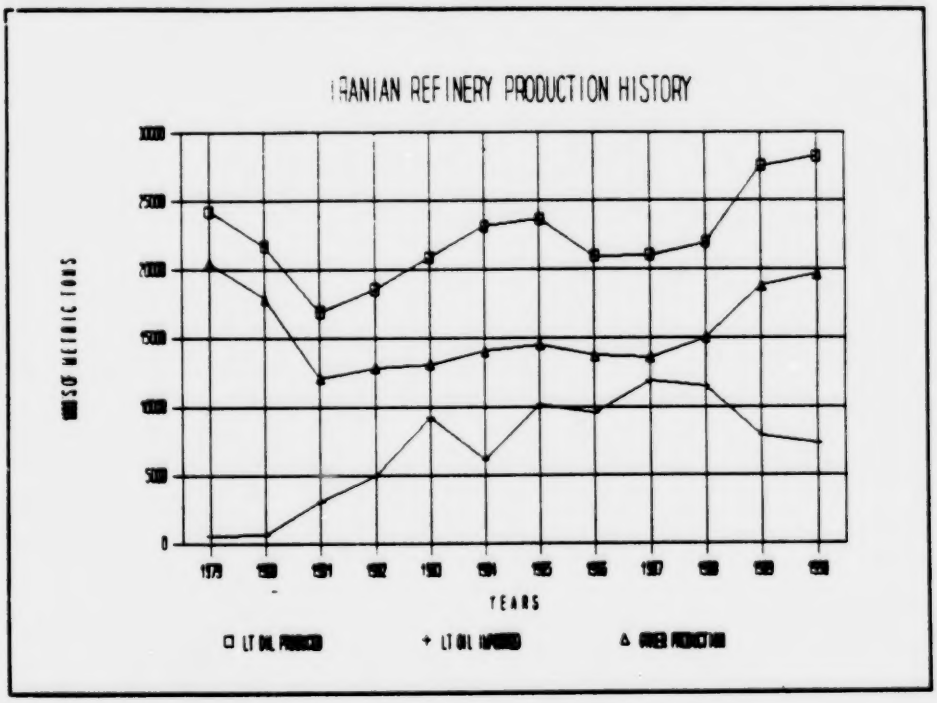
Figure B.1 shows the experience of Iranian refineries spanning the war years, the term "throughput" meaning the quantity of petroleum processed by the plants over a specified period (usually one day).

By far the largest in total throughput was the Abadan Refinery, which had the capability of processing almost 700,000 barrels per day. Only half of this throughput capability was integrated with the full range of secondary facilities needed to produce such products as motor gasoline, kerosene, jet fuel and diesel fuel (so-called "light fuels") for the domestic market, however, with the result that the plant yielded almost 50 per cent "heavy" fuel, a low valued product, most of which was exported. Each of the other six refineries is strategically located to serve a particular area and market: in most cases the topography of the country has influenced the choice of location. The large plants, at Tehran, Esfahan and Tabriz, are the key facilities in the supply network. All three were completely integrated refineries, producing for the domestic market high volumes of the light fuels cited above. The remaining refineries (Shiraz, Bakhtaran and Lavan) are much smaller in capacity and serve smaller speciality markets. Shiraz is worthy of special note in that it anchors a growing and extensive petrochemical complex in a attractive area of the country.

Direct damages

The outbreak of war in 1980 put all seven refineries under attack from the air with heavy damage and widespread disruption of petroleum product supply, particularly at Abadan. This interruption of normal supply grew in intensity and is illustrated by figure B.2. The three historical lines shown are for light fuels, other products (the by-products and residua such as propane, heavy fuel and sulfur) and imports (chiefly motor gasoline, jet fuel, kerosene and diesel fuel) made necessary by the interruptions and shutdowns of refinery production.

Figure B.2



The data show that the import of light fuels reached over 200,000 b.p.d. in the 1985-1987 period. The mission was informed that the import total from 1980 to 1988 was close to 500 million barrels; this would have meant an outlay of over $5,000 million of hard currency. The Government informed the mission that rationing was in force throughout the war period. It further advised that the real demand level was therefore masked and that the import level might otherwise have reached over 400,000 b.p.d. It should be noted however that, except for Abadan, refinery throughput is back to pre-war levels. In fact, at the Tehran and Esfahan refineries, debottlenecking projects have successfully raised the throughput levels significantly beyond pre-war peaks.

Abadan

At Abadan, the recovery has been slow because of the extent of devastation and today throughput has reached only about 350,000 b.p.d., half its original capacity, but it is operating at about 200,000 b.p.d. owing to the lack of crude. The current refining strategy for Abadan is to reach and maintain about 400,000 b.p.d. and develop the secondary units to match this level. Future refining plans for Abadan are not yet clearly defined, although it was hinted that the Government might restore the throughput to its pre-war level. The principal factors influencing planning for the refinery and the area may be summarized as follows:

(a) The desire to maintain a strong and viable refining industry base in the area to anchor the rebuilding of Khorramshahr and Abadan;

(b) The existence of facilities, albeit needing repair and modification, together with a strong base in terms of human resources and technical skills;

(c) The very symbolic nature of Abadan itself.

The statistical record of production and yield for the Abadan refinery (and for each of the other refineries) has been presented to the mission and is on file for the record.

Tehran

This plant is located about 20 miles south of the city and today has a capacity of 250,000 b.p.d. It was attacked on two occasions during the war and lost 247 days of productive capacity in consequence. The extent of the damage, although dramatic at the time, was relatively minor and on each occasion repairs were made with extreme dedicated effort. Today, in addition to maintaining the production level, NIOC has been successful in debottlenecking the refinery to a throughput of close to 300,000 b.p.d.

Esfahan

In 1979, just before the outbreak of the war, Esfahan refinery was a new plant just starting up. Seven attacks during the war resulted in a loss of 364 days of operation, but reconstruction went forward after each attack to maintain productive capability. Recently, the plant has been debottlenecked and has been operating at close to 300,000 b.p.d. Its technology is only 10 years old, but many temporary repairs still need permanent correction.

Tabriz

This refinery is located in the extreme north-west of the country and is about 18 years old. It endured a total of 14 attacks during the eight-year war, which resulted in 238 days of lost production; the mountainous terrain and relative inaccessibility probably saved it from more frequent attack. The interruptions in production were fairly short as the plant was reconstructed after each attack; it operates today at almost 90,000 b.p.d.

Shiraz

Although the Shiraz refinery and its neighbouring petrochemical complex is strategically important, its distance from the war activity precluded frequent attack. Only four attacks were said to have been made on the refinery; these resulted in the loss of only 165 days production in the eight years. The refinery today is operating at the 35,000-b.p.d. level.

Bakhtaran

As the Bakhtaran refinery was situated close to the Iraqi border, it was not only the subject of air attack but was also in proximity to the ground action. The result was 1,400 lost production days; in fact, the refinery was shut down completely during 1981 and 1982, owing to the destruction of the crude pipeline supplying raw material. The refinery is now once again operating at capacity of about 25,000 b.p.d., serving a localized demand in the western part of the country.

Lavan

This small topping plant on the island of Lavan off the southern coast supplies the local needs of the island community and its crude production plant which services several important offshore oilfields. The frequent attacks on these fields and their associated facilities led to two attacks on Lavan plant and 53 days of lost production. Reconstruction of the 20,000 barrel per day plant was relatively minor.

7. Reconstruction costs

The Government provided the mission with the following reconstruction costs for the seven refineries, based on expenses incurred during the war and those incurred since the cease-fire.

Table B.3. Reconstruction costs of refineries

(In millions of rials and dollars)

Place	War time		Cease-fire		Total	
	Rls	$	Rls	US$	Rls	US$
Abadan	4 739	89	8 772	164	13 511	253
Tehran	679	13	232	4	911	17
Esfahan	963	18	511	10	1 474	28
Shiraz and Lavan	643	12	509	10	1 152	22
Tabriz	1 114	21	224	4	1 338	25
Bakhtaran	508	9	140	3	648	12
Total	8 646	162	10 388	195	19 034	357

The total cost of reconstruction by the Government's estimate is thus Rls 19,034 million and $357 million. The worksheet underlying this table has been provided to the mission and is on file for the record.

As can be seen, most of the cost is centred in Abadan. In the other refineries, reconstruction has restored capacity to or beyond pre-war levels. However, the status of these plants is acceptable only in 1980 technological and mechanical terms. Ten- to 15-year-old instruments, controls and other equipment leaves the Islamic Republic of Iran technologically behind and operating well below modern efficiency standards. Moreover, the mission was informed that reconstruction costs to date are only 45 per cent of the total necessary to restore pre-war condition and productive capability. Thus, a further sum of Rls 42,298 million and $793 million would be required to complete the reconstruction work. The Government further stated that it was formulating plans to proceed with the balance under a specific time-frame. However, the details have not yet been spelled out.

In connection with these plans for future reconstruction and development, the mission emphasizes that the critical issue is to ascertain what kind of operation the refineries are capable of sustaining. In this regard, the normal indicative criteria are:

(a) Saleable yield;

(b) Percentage yield of light oil versus heavy fuel;

(c) Fuel consumption;

(d) Losses.

The saleable yield record shows quite average values for the industry (94 to 96 per cent). However, the mission was informed that weight percentage losses are close to 0.5 per cent; this is not a good result, for weight percentage losses are real and visible and the refinery closings should be tight except for flare. From the limited data available, it appears that fuel consumption is above average; moreover, the mission observed little evidence of energy conservation equipment (which is hardly surprising with binding financial resource constraints). Most important, it appears to the mission that, as light oil (gasoline, kerosene and diesel) is being imported at high cost, the light oil to heavy oil ratio is far too low. This suggests that the refinery configurations need reexamination.

The mission was provided a list of capital expenditures planned for the next several years, which is on file for the record. Upgrading capital does not appear to be in the planning forecast. In fact, much of the planned work has to do with expanded capacity, lead reduction in gasoline and added lubricating oil production. These are all projects studied and planned in the normal scheme of industry development and are not related to reconstruction due to war damage; they have therefore not been included here. It should, however, be noted that two new refineries at Bandar Abbas and Arak, although already partially built, have been placed on hold on account of shortages of capital; completion is currently planned for 1994 and 1997 respectively.

8. Petrochemicals

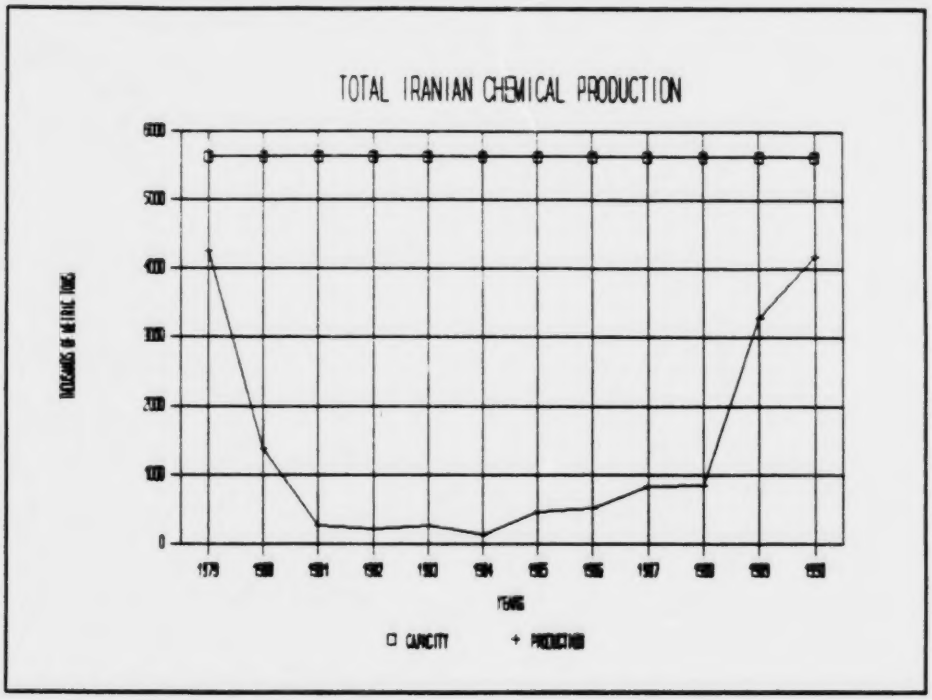
Damage

The petrochemical industry was devastated by the war. The location of the majority of the industry along the northern shore of the Persian Gulf meant that the facilities were within easy range of aerial attack. The huge joint-venture plant at Bandar-e-Imam Khomeini was more than 60 per cent completed when the war began. Its products were for the most part to be exported and were expected to provide major revenue for the country. As a consequence of the war, work on this project has had to be suspended, since the damages sustained and the risk and cost of reconstruction during the war was too high. Indeed, the damage to the entire petrochemical sector was such that, for several years during the middle of the war, production at all chemical plants was virtually halted.

The Government has presented the mission with a detailed list of all the petrochemical plants, their feed stocks and products by name and quantity for

the 12 years from 1979 to 1990; this is on file for the record. Figure B.3 shows the historical record and the capacity line emphasizes the production loss, which is shown to be in the order of 30 million tons of total petrochemical products over an eight-year period.

Figure B.3



All of the plants with the exception of the joint venture facility are once again operating near their capacity levels. However, much of the reconstruction is of a temporary nature and no major funding has been earmarked for lasting repair of the extensive patchwork.

Reconstruction costs

The Government has provided the mission with the following reconstruction costs for the seven petrochemical plants, based on expenses incurred during the war and those incurred since the cease-fire.

Table B.4. Reconstruction of petrochemical plants

(In millions of rials and dollars)

Place	War time		Cease-fire		Total	
	Rls	$	Rls	US$	Rls	US$
Abadan	1 304	24	3 305	62	4 609	86
Farabi	193	4	130	2	323	6
Imam Port	4 883	92	28 931	542	33 814	634
Raazi	1 542	29	899	17	2 441	46
Shiraz	4 582	86			4 582	86
Pasargad	1 139	21	3		1 142	21
Kharg	1 892	35	47	1	1 939	36
Total	15 535	291	33 315	624	48 850	915

The total cost of reconstruction by the Government's estimate is thus Rls 48,850 million and US$ 915 million. The worksheet underlying this table has been provided to the mission and is on file for the record. The mission was informed that reconstruction costs to date are only 45 per cent of the total necessary to restore pre-war condition and productive capability. Thus, a further sum of Rls 108,556 million or US$ 2,033 million would be required to complete the reconstruction work.

9. Concluding observations

The mission visited many of the refineries and petrochemical plants throughout the country. Analysis of the production data from all these plants confirms that from a purely production standpoint, both refining and petrochemical industries are now able to produce at close to their pre-war output levels.

Table B.5 summarizes the information provided by the Government on reconstruction costs for the seven refineries and seven petrochemical plants in the country, based on expenses incurred during the war plus those incurred since the cease-fire, and those expected to be incurred in the future.

Table B.5. Reconstruction costs

(In millions of rials and dollars)

Type	To date		Future		Total	
	Rls	$	Rls	$	Rls	$
Refinery	19 034	357	42 298	793	61 332	1 150
Petrochemical	48 850	915	108 556	2 033	157 406	2 948
Total	67 884	1 272	150 854	2 826	218 738	4 098

The total cost of reconstruction, both past and future, by the Government's estimate, is thus Rls 218,738 million and $4,098 million. The worksheet underlying this table has been provided to the mission and is on file for the record. This estimate is in line with the mission's own approximate calculation based on the rule-of-thumb accepted in the oil industry of current replacement cost for large plants at $10,000 per b.p.d. of capacity, with a sharply non-linear cost curve as capacity descends below 100,000 b.p.d. On this basis, the mission has very roughly estimated the total outlay of funds necessary for complete reconstruction at $5,000 million. If the rial figure estimated by the Government is converted at the mission's rate of Rls 300 per dollar in 1990 prices, it amounts to the equivalent of $729 million. Adding this to the estimated foreign exchange requirement of $4,098 million gives a total cost for complete reconstruction on the Government's estimate of $4,827 million, which is very close to the mission's rough estimate of $5,000 million.

It is a matter of great concern to the mission that the plants and refineries are technologically at best 10 years out of date. The time and cost of upgrading and of replacing the many temporary repairs soundly and securely is only now being programmed and planned. This work will have a sharp impact on the technological gap and requires careful attention to industry planning decisions. In addition to the obvious drain of such a vast programme on available human resources, money and materials there is the matter of access. The Islamic Republic of Iran must, in order to upgrade in a reasonable time-frame, have easy access to technology and industrial equipment. This will mean either acquiring such technology and equipment on the open market or providing the incentives to attract foreign investment capital into the country in a highly competitive financial environment where the needs are staggering, particularly in the third world.

Notes

1/ 1991 International Petroleum Encyclopedia, p. 297.

2/ World Bank Report No. 9072-IRN-7/30/91, p. 51, and extrapolated by oil production sector mission member.

C. TRANSPORT

1. Rail, roads and air transport

(a) Loss sustained by the transportation subsector

At stated in the first report of the team (S/22863), the Government has estimated the direct loss caused by the war in the transportation subsector at Rls 1,085.6 billions in terms of 1988 replacement costs. The loss sustained by the maritime transport subsector is not included in this total. The war caused a considerable delay in the development of the road and railway networks, as well as of the port capacities, and this in turn caused serious bottlenecks in the development of other sectors. This part of the loss is not visible in the transportation subsector itself.

A breakdown of the estimated direct loss in the subsector is presented in table C.1.

Table C.1. Direct losses in transport sector

(In millions of rials)

Subsector	Buildings and installations	Machinery and equipment	Materials and goods	Total
Land	54 858	965 729	0	1 020 587
Air	13 809	35 331	0	49 140
Storage	10 490	5 331	52	15 873
Total	79 157	1 006 391	52	1 085 600

The loss of machinery and equipment constitutes 92.7 per cent of the total direct loss sustained by this subsector. It is the mission's view that this proportion does not adequately reflect the real relations between the elements of direct loss. Most of the damage sustained by buildings and installations in the transportation subsector were quickly repaired, in many cases several times, during the war. These multiple repairs are not visible now, but they have been reflected in the estimate of the direct loss.

The Government has estimated the costs of reconstruction to date in the transport sector at Rls 124,066 million and expects the future costs to complete the reconstruction already planned to be Rls 63,937 million in foreign exchange and Rls 225,746 million in local currency.

(b) Land transportation

Damage

In 1980 there was a total of 4,570 kilometres of single-track lines and Iranian Railways carried 5 million passengers and 5.7 million tons of freight. By 1988, at the end of the war, the track length had increased to 4,834 kilometres, with 6.8 million passengers carried and 12.5 million tons of freight. During the war period the number of freight wagons increased from 12,150 to 13,312 and the number of passenger coaches increased from 760 to 925. During the same period the number of locomotives increased from 418 to 531.

The direct loss in rail transportation, as presented by the Iranian authorities, consists of the following parts:

(a) Buildings and installations:

150 km of railway lines damaged 100 per cent
118,569 m^2 of buildings damaged from 20 per cent to 100 per cent
292 bridges and culverts damaged 85 per cent
3 major bridges damaged 42 per cent
2 major bridges damaged 24 per cent

(b) Machinery and equipment:

(i) Telecommunications and signalling systems:
120 km damaged 100 per cent
107 km damaged 55 per cent
146 km damaged 15 per cent

(ii) Electrical equipment and network:
120 km damaged 100 per cent
107 km damaged 45 per cent
146 km damaged 20 per cent

(iii) Wagons and locomotives:
956 wagons damaged from 35 per cent to 85 per cent
21 locomotives damaged from 30 per cent to 75 per cent

A detailed list of losses was presented to the mission and is on file for the record.

The direct loss sustained by railways was estimated by the Government at Rls 55,775 millions in foreign currency and Rls 38,932 millions in local currency. These figures include both building and equipment losses. With regard to buildings and installations, most damage was caused to railway stations, marshalling yards and five major bridges. The major damage to rail tracks and associated equipment occurred in Khuzestan Province, in particular to the Ahwaz-Khorramshahr line. This 120-kilometre line is reported to have

been entirely destroyed during the ground war. The bridge at Qotoc near the Turkish border was also damaged and the major line for the flow of goods to and from Turkey was closed for several months. Rail equipment, reportedly in rolling stock, has been estimated as one of the major losses in the transportation subsector.

The mission has made attempts to verify all severe damages and to assess the extent of loss suffered by the rail transportation, as reported by the Iranian authorities. Three major and five minor railway stations, 60 kilometres of track and four major bridges were inspected by the mission. The inspection was aided by photographs taken at the time of the damage. The mission has inspected the following:

Major railway stations:	Khorramshahr, Ahwaz and Andimeshk;
Minor railway stations:	Hoseyniyeh, Hamid, SarBandar, Haft Tappeh and Tolezang;
The railway line:	Ahwaz-Khorramshahr; and
Railway bridges:	Ahwaz, Karun river, Tolezang, Souili and Qotoc.

However, the exact number of destroyed wagons and locomotives, as reported by the railway authorities, could not be verified.

Most of damage caused to railway stations, tracks and marshalling yards was temporarily repaired immediately after damage and destroyed rolling stock was replaced either during or immediately after the war. Considerable reconstruction work has been carried out on several railway stations and bridges, thereby leaving no traces of the damage in many places. However, the mission saw evidence of the ruins of destroyed buildings, as well as debris and destroyed equipment. These were consistent with the damage reports and photos. A description of both the damage and the reconstruction work inspected by the mission is contained in the first report of the team of experts.

The monetary value of the damage caused to buildings and installations, as presented by the Iranian authorities, appears to be appropriate. However, the mission was not able to verify the extent of damage caused to rolling stock and equipment, as most of damaged wagons, locomotives and other equipment had already been cleared from tracks and depots.

Roads

As stated in the first report, roads are by far the most important mode of transportation in the Islamic Republic of Iran, for both passengers and goods. There are over 2,000 road transport companies in the country, of which fewer than 6 per cent are government owned. Of total domestic freight, some 85 per cent is by road, whereas only 10 per cent of international freight is

by road. The total volume of freight by road is estimated at 90 million tons. In 1980 there were about 160,000 kilometres of all-weather roads, of which 42 per cent was fully paved. By 1989, the road network comprised a total of 167,156 kilometres outside urban areas. At that time, there were over 1 million automobiles and nearly half a million trucks and buses.

The direct loss in road transportation as presented to the mission by the Iranian authorities consists of the following elements:

Buildings and installations

Roads damaged:

Khuzestan province:	1 533 km
Ilam province:	600 km
Bakhtaran province:	845 km
Kurdistan province:	555 km
Azarbayjan province:	330 km

(The above figures include main and feeder roads, as well as minor bridges and culverts.)

Major bridges:

Khuzestan province:	11 bridges
Ilam province:	10 bridges

Machinery and equipment for road maintenance:

321 pieces of road maintenance equipment damaged in most cases 100 per cent. The loss is estimated at Rls 6,000 million in foreign currency.

Damage was also suffered by some district road offices and loss of equipment for road maintenance was reported as follows:

Khuzestan province:	7 offices, total 1,489 m^2
Ilam province:	5 offices, total 940 m^2
Bakhtaran province:	1 office, total 4,000 m^2

A detailed list of losses was presented to the mission and is on file for the record.

Extensive damage to roads was evident in all border areas, particularly in sectors where ground warfare and occupation had taken place. Besides these damaged roads, roads in the cities and towns close to the border also suffered considerable damage, particularly in Khorramshahr, where it is estimated that 80 per cent of all roads require rehabilitation or resurfacing; and in Abadan, where 40 per cent of all roads were reported to have been damaged by the war.

The direct loss sustained by roads was estimated by the Iranian authorities at Rls 36,014 million in foreign currency and Rls 79,938 million in local currency. These figures include both building and equipment losses.

The mission has made attempts to verify all severe damage and to assess the extent of the loss to road transportation reported by the Iranian authorities. 1,360 kilometres of roads, 40 major bridges and numerous minor bridges and culverts were inspected by the mission. A further 500 kilometres of roads were inspected by low- flying helicopter. The inspection was aided by photographs taken at the time of the damage. The detail of these inspections is as follows:

Roads:	790 kilometres in Khuzestan Province 230 kilometres in Ilam Province 340 kilometres in Bakhtaran Province
Major bridges:	Khorramshahr, Abadan, Ahwaz, Karkheb river, Susan-Guerd, Bostan Town, Djesr Naderi, Changuleh, Zagavi, Kondjancham 1,2,3, Haftdhaneh, Naftshahr, Tangab, Emam Abbas, and other major bridges in provinces: Khuzestan, Ilam, Bakhtaran and Emam Abbas.

The mission also inspected four district road offices in Khuzestan. Although the sites had been cleared and partially rebuilt, there remained evidence of damage.

The mission was also able to observe damage inflicted on roads and bridges in the main theatre of war during the conflict. Damage to roads was caused by both bombardment and abnormal overweight traffic loads. Many of the roads had been resurfaced during the war and the same damage caused by overweight vehicles is again apparent. The roads did not receive normal routine maintenance during the war and this accelerated the deterioration of the road surfaces and structures. There is no doubt that the road network suffered extensive damage over and above normal wear and tear. Damage to major bridges and to most of the small bridges and culverts was caused by direct bombardment, but in many cases there were also damages reported to minor bridges from overweight vehicles.

Reconstruction work has been carried out on roads and bridges. Many roads have already been resurfaced and bridges rebuilt or repaired. For this reason, the damage is not evident in many places. However, the inspection confirmed, that in most cases the reconstruction was consistent with the damage reports and photos. A description of the damage and of reconstruction work inspected by the mission may be found in the first report of the United Nations team of experts.

The monetary value of the damage caused to roads and road bridges, as presented by the Iranian authorities, appears to be underestimated. Most damage to the roads was not caused by direct bombardment, but by overloaded vehicles and/or due to lack of appropriate maintenance during or immediately

after the war. In many cases, damage has been caused not only to the road pavement but also to the lower courses of the road structure. This will require both rehabilitation and resurfacing. Moreover, roads outside the border areas suffered deterioration owing to indirect war-related causes. Because of the priorities given to the border areas, only relatively small repairs and improvements to the country road network could be undertaken during the war period. This has resulted in a deterioration of the overall quality of the road system. This general damage to the road system, as well as the necessity to rehabilitate roads in the areas of war operations does not, in the mission's view, appear to be reflected in the estimate of war damage. The mission was not able to verify the extent of damage caused to equipment for road maintenance, as damaged equipment had already been cleared from road sites and depots.

Reconstruction work observed by the mission

An impressive amount of reconstruction has already been carried out in the land transportation subsector, both during and after the war. It was essential for the war efforts to keep transport corridors open in the border provinces so that reconstruction work on roads and railways was executed during the war and in many cases repeated several times. However, this repair work was in most cases of a temporary nature, and more thorough reconstruction needs to be undertaken. The task of reconstruction is immense and it will take many years before it can be completed.

The severely damaged railway line Ahwaz-Khorramshahr has been repaired and reconstructed, but the work carried out was only of a temporary nature. The mission was informed that the transport capacity of this line before the war was seven to eight freight trains (2,000 tons' load) per day. Because of poor track conditions, the capacity at present is only two trains per day, with a limited speed of 45 km/h. It is planned to upgrade the railway line to allow a maximum speed of 100 km/h and trains of 5,000 tons load. The present Khorramshahr station has been rebuilt in the vicinity of the destroyed station. The station has at present only 6 operative tracks compared with 11 operative tracks before the war. A new station complex is proposed to be built 300 metres up-line. The Ahwaz station has been rebuilt and is now operable.

Reconstruction of roads damaged by shell fire or overloaded vehicles was effected only by resurfacing or applying an overlay on the damaged pavement. The authorities are quite aware of the real magnitude of the problem and resurfacing is considered as a temporary measure only. Because of an apparent lack of funds, no proper reconstruction has yet been undertaken, and many recently paved roads will need to be resurfaced. In most cases, only full rehabilitation of the road structure can be considered as an appropriate way of reconstruction of damaged roads. Moreover, a great deal of repair and rehabilitation of road drainage, shoulders, markings and signs is also required.

Many bridges were reportedly damaged and repaired on several occasions during the war. Circumstances made it necessary to use Bailey and pontoon bridges to bridge rivers, and simple steel plates and steel beams have been used to bridge damaged areas. In general, a more permanent form of reconstruction is needed to be undertaken.

Reconstruction plans and needs

The reconstruction of the transportation sector is recognized by the Iranian authorities as one of the prerequisites for the reconstruction of other sectors. Unfortunately, it has not been possible to reconstruct, modernize and develop land transport facilities to the extent needed, and this has caused serious bottlenecks in the execution of reconstruction work in other sectors. As mentioned above, much of the reconstruction carried out during or immediately after the war was only temporary. The Iranian authorities have now prepared sectoral reconstruction plans showing priorities and time schedules. The plans were presented to the mission and are on file for the record. Although part of the reconstruction programme has been implemented, enabling transport flows on the most important lines, a much greater part remains to be implemented.

With the exception of railway tracks, the reconstruction of land transport physical infrastructure has been carried out by Iranian construction companies, the majority of which are privately owned. Railway track reconstruction is carried out by Iranian Railways. All work has been planned and designed by Iranian engineers and executed by Iranian skilled manpower. Some types of construction plant and machinery used in reconstruction work are manufactured in the country, but a great deal of plant has been imported. The mission observed that the reconstruction work performed is of high quality, even in complex undertakings such as bridge construction.

The mission noted that a large proportion of the construction plant and machinery needed is not manufactured in the country. Consequently, a considerable amount of foreign currency is required to cover the cost of imported items. Reconstruction of rolling stock and railway equipment also requires a foreign currency component for material and parts not locally manufactured. While railway freight wagons and passenger coaches are manufactured locally, their wheels and axles as well as some types of bogies have to be purchased abroad. Moreover, maintenance equipment for roads and railways, as well as locomotives and heavy trucks also need to be imported. Since the damage to machinery and equipment in the land transportation subsector was considerably higher than the reported damage to structures and installations, replacement of this equipment also requires a significant amount of foreign currency. Taking all factors into account, it is envisaged in the reconstruction plan that foreign currency will be needed for 45.8 per cent of the budget to meet remaining reconstruction work in the land transportation field. This estimate appears to the mission to be reasonable.

The Government has established priorities in the reconstruction of land transport facilities. The main priority is given to the full reconstruction

and upgrading of the line Ahwaz-Khorramshahr and to the building of a new railway station at Khorramshahr. The construction of additional railway capacity to the port of Bandar Khomeyni and new railway capacity to the port of Bandar Abbas, as a consequence of the shifting of the former capacities of the Khorramshahr port to these two ports, will alleviate the land transportation problems and eliminate some of bottlenecks. The railway network also needs upgrading and modernization as well as renovation and additions to the rolling stock. This is considered urgent since railways will be expected to carry a considerably higher share of freight than at present. The country has the technical expertise and skilled manpower to carry out this immense and complicated task, but a considerable amount of foreign currency is needed for implementation of this plan.

In regard to roads, priority is given to the rehabilitation and improved maintenance of the main roads and reconstruction of the main bridges in the border provinces. The Government has estimated that the foreign currency component needed for the remaining road reconstruction work will be 30 per cent of the total budget. This money will be needed mostly for the procurement of equipment not manufactured in the country.

(c) Air transportation

Damage

Airports

In 1980, major international airports at Tehran, Bandar Abbas and Abadan were supplemented by 10 grade I and 11 grade II airports. By 1988, domestic services had increased to cover 38 towns. Seven of these airports are for international traffic and 12 are suitable for large aircraft. The list of all airports in operation was presented to the mission and is on file for the record. The number of air passengers in 1988 exceeded 5.6 million; import and export air cargo amounted to some 23,000 and 22,000 tons respectively.

Air corridors over the Islamic Republic of Iran were closed to international carriers during the war period, but have now reopened. All major airports in the border provinces were attached during the war and suffered varying degrees of damage. The Abadan airport suffered the most since it came under continuous bombardment by air and by artillery. With the closure of Abadan airport, the importance of Ahwaz airport increased making it also the target for frequent attacks by air. The damage to airports, as presented to the mission by the Iranian authorities, consists of the following:

Buildings and installations:

Airports damaged:

Abadan:	moderate to severe
Ahwaz:	moderate to severe
Bakhtaran:	moderate
Sanandaj:	minor to moderate
Urmiyeh:	minor to moderate
Tabriz:	minor to moderate

Other airports which sustained minor damages are Hamadan, Shiraz and Tehran

Machinery and equipment:

Terminal, control tower, lighting and other equipment was damaged at the airports of Abadan, Ahwaz and Bahtaran. There was also minor damage to the equipment on the other airports that were attacked.

Aircraft destroyed:

Iran Air:	2 Boeing 727	
	1 Airbus EP-IBS	
Asseman:	3 Fairchild	
	1 Shirk commander	

Aircraft damaged:

Iran Air:	1 Boeing 747	6 per cent
	1 Airbus	10 per cent

A list detailing losses was presented to the mission and is on file for the record.

Meteorological stations

The Meteorology Organization provides meteorological data to the aviation, shipping, agriculture and energy sectors. During the war, many of its climatological and synoptic stations were damaged. The damaged stations, as indicated by the Iranian authorities, are:

Climatological stations in:

Bakhtaran Province:	1 station	100 per cent damaged
Ilam Province:	1 station	100 per cent damaged
Kurdistan Province:	18 stations	100 per cent damaged
Azarbayjan Province:	2 stations	80-100 per cent damaged
Khuzestan Province:	7 stations	100 per cent damaged

Synoptic stations:

Six stations received damage ranging from 16 to 100 per cent. The detailed list of losses was presented to the mission and is on file for the record.

The direct loss sustained by air transportation, including both building and equipment losses, was estimated by the Iranian authorities at Rls 27,902 million in foreign currency and Rls 30,651 million in local currency.

The mission has endeavoured to verify all severe damage suffered by the air transportation subsector reported by the Iranian authorities. The mission visited four airports and several meteorological stations. As for the other subsectors, the inspection was aided by photographs taken at the time of the damage. Airports visited by the mission are Abadan, Ahwaz, Bakhtaran and Urmiyeh. The mission also visited Ahwaz, Dehloran, Bakhtaran and Susan-Guerd meteorological stations.

Damage inflicted on airports during the war was observed by the mission. Although reconstruction work had been carried out on the airports visited, the inspection confirmed that the ruins of former buildings and the pattern of reconstruction were consistent with the damage reports and photos. Damage said to have been inflicted on Shiraz, Hamadan and Tehran airports could not be verified.

The mission also observed debris of some destroyed aircraft. An additional description of the damage and of the reconstruction work inspected by the mission may be found in the team's first report.

The monetary value of the damage caused to the airport buildings and installations, as presented by the Iranian authorities, appears to be appropriate. The mission was not able to verify the exact extent of damage caused to aircraft and equipment, as most of them have already been repaired or cleared from the sites.

Reconstruction work observed by the mission

The Abadan airport has been reconstructed to the extent necessary to enable inland traffic operations. Domestic traffic will start by the end of November 1991. The main terminal, the control tower and the longer runway are under reconstruction and international traffic operation will begin in January 1993.

The Ahwaz airport is now operable, although the main terminal building, the apron and the runway, as well as the staff housing are still being repaired or reconstructed. Some development of the airport is being carried out in conjunction with the reconstruction.

The damaged structures and installations at Bakhtaran airport have been repaired and the airport is fully operable. The mission also found that the damage caused to the Urmiyeh airport had also been repaired. These latter two airports remained open throughout the war years.

Reconstruction plans

The Iranian authorities have given priority to the reconstruction and development of the air transportation subsector, because there are no viable alternatives to air travel for the vast long distances that need to be covered within the country. However, air transport facilities have yet to be reconstructed, modernized and developed to the level necessary. The Government has prepared a plan for the reconstruction of 18 airports, some damaged, several requiring expansion and a number to be built. Parts of this plan relating to the reconstruction of damaged airports were presented to the mission and are on file for the record. An amount of Rls 13,000 million in foreign currency has been included in the plan for the replacement of destroyed aircraft. Although some repair and reconstruction has already been effected, the greater part of the reconstruction plan needs to be implemented.

Assessment of implementation capability

The reconstruction of airport buildings, installations, runways, taxiways and aprons has been carried out by Iranian construction companies. Most of construction companies are privately owned. The work was planned and designed by Iranian engineers and executed by Iranian skilled manpower. The mission observed that the reconstruction work performed meets quality standards even in undertakings with high technical requirements, such as runway construction. However, although some types of plant and machinery used in reconstruction work are manufactured in the country, a large proportion of capital equipment requires to be imported (for example, control towers and terminal equipment are not manufactured in the country). For this reason a considerable amount of foreign currency will be needed to cover import costs. Reconstruction and replacement of airport signalling and lighting systems, terminal, fire-fighting, meteorological and traffic control equipment will also require a considerable foreign currency component.

The authorities stated that most damaged or destroyed aircraft have already been repaired or replaced. Since the reported damage to aircraft and equipment in the air transportation subsector was considerably higher than the damage to structures and installations, the replacement of aircraft and equipment, as well as provision of spare parts, require a significant amount of foreign currency. The Government estimates that the foreign exchange component needed for the remaining reconstruction work will be 85.6 per cent of the total cost.

The full reconstruction and upgrading of the Abadan airport has been assigned top priority. The next priority has been given to the reconstruction of the Ahwaz airport, to be followed by work on other damaged airports.

(d) Storage

The airport storage subsector embraces all activities relating to and facilities for public and private warehouses and refrigerating chambers engaged in the storing of various categories of goods. Direct loss to the storage subsector consists of the damage to buildings and installations (66 per cent) and of the damage to machinery and equipment (34 per cent). The amount of direct loss as estimated by the Iranian authorities constitutes only 1.3 per cent of the total direct loss sustained by the transportation sector. In most cases, the damage was caused by aerial attacks. The mission was not able to verify the extent and the monetary value of damage caused to storage facilities, as most of them have already been repaired. However, it did observe a totally destroyed building with refrigerating chambers at Abadan. The mission also visited a destroyed silo at Ahwaz.

2. Ports and marine salvage

The Iranian port and marine system plays a key role in the country's economy as a major industry providing employment and as the main agent for foreign trade. Authority over ports and the merchant fleet is exercised by the Port and Shipping Organization (PSO) for all commercial activities, except those involved in the oil industry which are under the authority of the National Iranian Oil Company (NIOC).

Both organizations are extensively involved in reconstruction and rehabilitation of their capacities, following the heavy damage and losses sustained during the conflict.

(a) Damage sustained in the conflict

Commercial ports

Within the system of commercial ports, the ports of Abadan, Bandar Khomeyni and Khorramshahr were the most severely damaged.

Khorramshahr and Abadan

Located alongside the Shatt al-Arab waterway, the ports of Abadan and Khorramshahr had initially been built by the oil industry for the handling of its supplies. Later, Khorramshahr became a major commercial port, for handling general cargo. Prior to the conflict, it could claim adequate nautical access, fairly good rail and road connections to northern and central parts of the country, and the advantages of a highly populated and industrialized location. Abadan played a more modest role as a commercial and oil supply port. Together, the two ports had a rated traffic capacity of 2 to 3 million tons per year, although through maintaining an exceptionally busy schedule, they managed to sustain an average of 6 million tons per year over several pre-war years. The Shatt al-Arab having been the scene of some fierce

ground fighting during the war, the ports of Khorramshahr and Abadan suffered complete destruction of their above-water structures and equipment and significant damage to their below-water installations.

Bandar Khomeyni

Bandar Khomeyni, the Islamic Republic of Iran's most modern port, was built in the mid-1970s. It is located in a highly industrialized region and is served by excellent maritime access and an adequate road and rail system almost equal to that enjoyed by Khorramshahr. The port handles a wide range of traffic, including conventional general cargo, containers, solid bulk (minerals, cereals, etc.) and liquid bulk (edible oils, etc.). It accommodated vessels of up to 60,000 tons dead weight. Although the port was not involved in land combat, it was situated within the range of aviation attack and suffered extensive damage to its above-water installations and equipment.

The ports of Abadan and Khorramshahr have remained closed since the end of hostilities. The reopening of the Shatt al-Arab to floating craft is an imperative condition for the undertaking of any reconstruction or repair work to the infrastructures of the ports. Given the evolution of marine technology since the 1970s, and depending upon the extent to which the river depths are restored (or even increased) following their clearance, the reconstruction of the ports may require some remodelling for new traffic (roll on-roll off, feeder containers, heavy load vessels, etc.) in addition to general cargo. At present, landside clearance of all debris (buildings, sheds, warehouses, mechanical equipment and cargoes deposited in the storage areas) is under way. Repairs to the port of Bandar Khomeyni are nearly complete and the port is now fully operational.

According to information provided to the mission by PSO, the work done on reconstruction of the commercial ports can be summarized as follows:

(a) During the war years, no amount was allocated towards the reconstruction of the above three ports. However, PSO made progress in the construction of a new major port at Bandar Abbas which is located at the entrance to the Persian Gulf, near the Strait of Hormuz. This port has a design capacity of 13 million tons/year, more than double the peak flows handled at Abadan and Khorramshahr combined. The construction was started in 1986 and was essentially completed during the war years at a total cost of $2,000 million;

(b) During the period 1988-1991 the amount allocated to on-site reconstruction was Rls 45,800 million, mainly for the reconstruction of the port of Khorramshahr, the repair of Bandar Khomeyni and, to a smaller extent, for the clearance of landside debris at the ports of Khorramshahr and Abadan. In addition, some Rls 3,000 million were spent on dredging Bahmanshir;

(c) The amount earmarked, or being considered, for war-related reconstruction activities in the future, by PSO is Rls 152,400 million plus

$4,060 million (the latter amount for imported mechanical equipment). This sum will be needed for the ports of Abadan and Khorramshahr, the completion of repairs at Bandar Khomeyni and for the dredging of the Shatt al-Arab and Bahmanshir.

Despite the rehabilitation of capacities which has already been undertaken at Bandar Abbas as a development within the framework of the ongoing plan for the growth and transformation of the country, the Government is committed to the reconstruction of Khorramshahr port because of the additional capacity which would be brought onstream and the effect it would have in increasing the fluidity of the traffic through the Iranian ports of the Persian Gulf. This would enable exporters and importers to claim more favourable freight rates for their cargoes and reduce the waiting time for berths during periods of congestion. Moreover, since transshipment to container feeder vessels, or to roll on-roll off vessels is an easy operation, the port of Khorramshahr could add its services to those of the port of Bandar Abbas, this latter acting as a major container port. This would reduce the need for land transport to central Iran from Bandar Abbas.

Oil ports

The heavy damage inflicted on oil ports was described in the first report of the United Nations mission (paras. 246-262). Nevertheless, a certain flow of crude oil exports was maintained during the war years (NIOC estimates the flow in one of the worst years, 1988, at nearly 90 million tons). In 1991, it is expected that the level of the best pre-war year (120 million tons) will be nearly attained. Concurrently, imports of refined products which became necessary owing to the damage suffered by the refineries have been reduced progressively from a maximum of 13 million tons in 1987 to an expected 7 million tons in 1991. This is attributed to:

(a) The significant margin of capacity of the oil ports system, compared with the pre-war traffic requirements;

(b) The intensive use of available capacities;

(c) The repair activities during the war years;

(d) The final repairs undertaken progressively to complete the provisional repairs.

NIOC has provided the mission with the following summary table of reconstruction and renovation expenditures for damaged/destroyed port facilities from the onset of the war to the present:

Table 1. Reconstruction expenditure on port facilities
(Millions of Rls and US$)

Place	During war time		Since cease-fire		Total	
	Rls	US$	Rls	US$	Rls	US$
Mah-Shahr and Abadan	386.6	16.6	525.9	22.5	912.5	39.1
Lavan	154.0	6.6	3 887.0	166.6	4 041.0	173.2
Kharg	1 891.0	81.0	9 622.3	412.4	11 513.3	493.4
Total	2 431.6	104.2	14 035.2	601.5	16 466.8	705.7

Despite the very substantial amount of repair work undertaken during the war, major rehabilitation and reconstruction work remains to be performed. Much of the war-related repair work was of a temporary nature, and the continued attacks throughout the war (many installations were hit several times during the conflict) rendered permanent reconstruction work impossible. Planned reconstruction work includes a $225 million contract for the reconstruction of the Kharg terminals (T-jetty and Sea Island). Other minor contracts, for the completion of restoration work at Kharg Island, as well as at Bandar Mah-Shahr are being considered.

Shipping

Although shipping losses in the Shatt al-Arab and the Karun River (discussed in the mission's first report (S/22863)) were substantial, the marine war was not confined to these areas. The Persian Gulf itself became the site of a "tanker war". Attacks concentrated on the approaches to Bandar Khomeyni, as well as on and nearby Kharg Island, Siri Island, Lavan Island and Hormuz. The mission was informed that during the period 1981-1988, 547 vessels are recorded as having been hit in attacks on Persian Gulf waters, 75 per cent of them being tankers, liquefied petroleum gas (LPG) and combination carriers, and the remainder being dry cargo vessels. On average, one in five of the vessels hit was recorded as a total loss. Many of the vessels hit were chartered foreign vessels, covered by international insurance, whilst vessels flying the national Iranian flag were covered by local insurance. Thus even if shipowners were compensated, the burden of loss for these ships fell on the Iranian economy. They have now either been replaced by repaired vessels or by new tonnage.

The direct losses of Iranian commercial cargo vessels - including those blockaded in the Shatt al-Arab - have been reported to the mission by PSO as having amounted to 17 vessels totally destroyed; 18 vessels were completely repaired, for a total cost of US$ 201,164,610.

The national oil fleet is operated by the National Iranian Tanker Company (NITC). During the period since 1981 until the present, its tonnage increased from approximately 5.5 million dead weight tons (28 vessels), to 6.6 million dead weight tons (33 vessels). Ships were bought to replace destroyed tonnage and to provide for the needs of the transshipment system set up between the exposed waters of the north of the Persian Gulf and the safer waters of the Gulf of Hormuz. NITC furnished the mission with the following data stating that a total of $498 million had been allocated for repair and replacement of damaged ships. Details are as follows:

Repairs: a total of Rls 13,600 million, converted by NITC to $170 million, for the purposes of:

- Provisional and minimum repairs to stricken vessels (39 ships)

- Completed repairs to 28 of above ships

- Ongoing repairs to 8 ships to be completed in 1992

New Shipping: a total of $328 million for repairs or replacement of off-shore boats

Indirect losses are estimated at $1,500 million, which includes loss of crude oil either set on fire or which leaked into the sea.

(b) Need for marine clearance operations

Shatt al-Arab and Karun River

The Shatt al-Arab, which forms part of the boundary between the Islamic Republic of Iran and Iraq, is navigable for sea-going vessels for 140 kilometres. The major ports of Khorramshahr (Islamic Republic of Iran) and Basrah (Iraq) are located on the river. Prior to the outbreak of hostilities, the waterway was administered by a joint commission, the Combined Bureau of Coordination, chaired alternately by the Islamic Republic of Iran and Iraq on an annual basis. Costs and revenues were equally shared.

On the Iranian side, Khorramshahr and its surroundings were the focus of intense fighting throughout the war. Initially limited to a conflict of land forces, the war escalated into attacks on shipping in the rivers. Many vessels were sunk and almost all initially damaged. Significant to future reconstruction efforts, several Iranian dredges escaped damage and are employed today.

The continued closure of the Shatt al-Arab and the presence of sunken ships has had grave consequences for the economy and a serious impact on the environment. The waterway is in a continuing polluting state as fuel and cargoes of uncertain composition leak into the water. Moreover, the destruction of the ports of Khorramshahr and Abadan, along with the closure of the waterway has limited the employment possibilities of most of the

inhabitants of the two cities and their surrounding areas, who relied on the shipping and refinery industries for their livelihood. The local fish industry has all but been destroyed since few fisherman will venture out into the present dangerous waters of the Shatt al-Arab.

As the mission was unable to overfly the river, various vantage points on the Iranian shore were utilized to sight the wrecks. From the jetties at Khorramshahr and Abadan, many sunken ships and barges were sighted - on the banks, in mid-river and alongside the jetties. At Khorramshahr in the Sfealieh Canal and on the Karun River, there were also several smaller wrecks. At approximately mile 26 from the mouth of the Shatt al-Arab in the vicinity of the Iraqi town of Al Faw and the military bridges are a total of 11 wrecks of varying sizes. More details on the areas where sunken ships are located in the Shatt al-Arab are provided in map 1 of the main report.

A list furnished to the first mission by the International Maritime Organization, identifies 86 ships that had either been sunk or immobilized in the Shatt al-Arab as of the date of that report (see S/22863, appendix B, item 22 (f). Plots maintained by the Ports and Shipping Organization of the Transport Ministry show the locations of only 35 wrecks. The mission infers from this that some of the ships mentioned in the first report either escaped or have sunk to the river bed.

The mission notes that the rough total of 800 ships mentioned in the first report includes many small barges, tugs, fishing vessels, etc. beached on both banks. Some of the wreckage may even predate hostilities; most pose no great clearance problem and no hindrance to the operation of the river channel.

The mission was concerned by the fact that the waterway could well contain various types of unexploded ordnance, the amount of which may never be precisely determined. Added to this situation is the complicating factor of silt accumulation which tends to bury such material, hampering normal detection and requiring the use of the most advanced and sophisticated detection equipment. It is almost 12 years since the waterway was last dredged. The silt has deepened and, under compression, has become heavy mud, making it difficult to remove, especially within hulls.

Many of the sunken ships may have contained genuine cargo. Although the value of any salvaged cargo and of the scrapped ships may be small in comparison to the cost of salvage, ownership may be contended.

The mission emphasizes that before any clearance work can commence in the Shatt al-Arab, a solution needs to be found to guarantee the safety of any salvage work force. Provision would also need to be made for the full disclosure by all parties of the types of ordnance used or transported in the area, particularly the presence, if any, of hazardous chemicals. Similarly, the cargo manifests of the damaged ships would need to be made available for determination of the presence of all cargoes, and the banks of the river cleared of mines and other dangerous obstacles which could impair salvage personnel and equipment.

The mission was informed that the Government of the Islamic Republic of Iran had received proposals from foreign Governments and private firms to accomplish the clearance of both wrecks and ordnance from the Shatt al-Arab, but no response has yet been made to these proposals. The only available plan relative to the river is a pre-war plan to dredge the Shatt al-Arab to provide for a draft of 30 feet. Furthermore, the mission has been informed by the Transport Ministry that the Iranian Navy has been assigned the responsibility of clearing explosive material from the waters. The mission has not been able to establish the Navy's capacities in this regard. It is not known whether the Navy possesses the state-of-the-art technology or expertise to perform the task.

In the event of international assistance being required to assist in the clearance of the waterway, further discussions will need to be held with the Iranian authorities on the availability of salvage-oriented divers who can perform under the most disadvantaged and hazardous conditions. Additionally, there would be need to know whether the Navy possesses the necessary management skills and job experience to conduct an operation of this magnitude. The private sector does seem attuned to the enormity and complexity of the task, and there prevails a sense of dedication, aggressiveness and ingenuity that could be harnessed to perform first the small tasks and then graduate to the bigger projects as experience broadens and skills improve.

The equipment required for wreck removal is akin to that of the marine construction industry. Heavy and light capacity cranes, dredges, welding machines, generators, pumps and recompression chambers are the major components of the equipment inventory. Tugs, barges, work boats and launches are necessary ancillary equipment. Berthing barges for remote or heavily damaged areas might also be required. Much of this equipment is available in the country (with the exception of heavy lift cranes of 500-1,000 tons). On the other hand, whilst some detection equipment is available, it may not be state-of-the-art. The utmost in current technology will be required to detect and locate the explosives presumably buried under several metres of silt.

The Ministry of Transport has informed the mission that it estimates the clearance of the explosives and wrecks from the Shatt al-Arab to cost $1,600 million and the dredging to cost $1,800 million. These figures are subject to great uncertainty as no realistic figures can be developed without a proper survey and, in fact, the actual cost may not be known until the work is undertaken and completed.

Other rivers

To a lesser degree, the conditions found in the Shatt al-Arab are also present in the Karun, Bahmanshire and the Khour-e-Musa rivers.

The Khour-e-Musa

The ports of Bandar Imam Khomeyni and Bandar Mahshahr are located a short distance from each other. They survived bomb and missile attacks and today are fully operational, although there are several wrecks in the vicinity. One wreck at Beacon No. 5 lies partially within the channel and should be removed.

The Bahmanshire

Several small wrecks and wrecked bridges are blocking traffic on the Bahmanshire, a small river 80 kilometres long, to the east of Abadan. The Government is considering plans to clear this and dredge it to 4 metres mainly to harbour fishing boats.

Kharg Island

Both the T-jetty and Sea Island terminals at Kharg Island are in use and able to handle the current level of traffic. However, the approaches to the T-jetty at Kharg Island are hazarded by the presence of a partially sunk tanker about 1 1/2-2 miles offshore. At the Sea Island complex, the remains of a burned-out tanker lie close to the shore and pose a problem for berthing ships on the shore side of the island. The removal of both wrecks is therefore recommended by the mission.

Siri and Lavan islands

The mission was informed by the Iranian Offshore Oil Corporation, which has jurisdiction for Siri and Lavan islands, that there remained no real obstruction in the Siri and Lavan waterways. However, the cost of removing the ship wrecks which occurred during the conflict away from the navigation lanes was not yet available at the time of the mission's departure from the Islamic Republic of Iran.

The Persian Gulf

There are many other wrecks in the Persian Gulf but they appear to be the concern of the other sovereign States or the concern of the Regional Organization for the Protection of the Marine Environment (ROPME), of which the Islamic Republic of Iran and Iraq are members.

D. INDUSTRY

1. Heavy industry

The sector comprises in particular the iron and steel and aluminum industry, including their downstream facilities for metal transformation and the heavy manufacturing industry. Because huge quantities of raw materials and energy (electricity, fuel, gas and coal) are required to ensure satisfactory production and output levels, the majority of these industries is located in the south of the country in relative vicinity to the Persian Gulf ports.

During the conflict many factories were totally destroyed, either by enemy attack or through occupation. In other regions outside the war zone, industrial plants were subjected to air and missile attacks.

The damage sustained by the heavy industry sector is well documented by photos, videos and selected on-site inspections. The mission visited the industrial installation in Arak (province of Markazi), which is the country's main aluminium-producing and aluminum downstream industry; further, the mission inspected the steel plant in Ahwaz (province of Khuzestan) with its downstream facilities in the city's vicinity.

(a) Estimate of damage

According to Government sources, the direct damage sustained by the industrial sector is estimated at rials 1,626,860, of which about two thirds, or rials 1,102,029, are attributed to all types of industries under the umbrella of the Ministry of Heavy Industry.

On-site inspection enabled the mission to verify the order of magnitude of damage and the expenditure estimate for reconstruction in respect of 12 installations in the metallurgical and manufacturing sub-sectors affected by the conflict (a description of these industries including general observations, cost estimates, etc. are provided in annex I to the present report).

(b) Government priorities and targets

The development of the metallurgical sector, especially iron and steel, has been one of Government's priorities for many years in its effort to reach self-sufficiency and industrial diversification by developing important downstream facilities.

In 1980, steel accounted for almost one sixth of total imports and annual steel consumption was estimated at 6 million tons. During the years of the conflict domestic steel production was below 1.5 million tons, mainly produced by an old-fashioned, coal-based steel mill at Esfahan. After the conflict,

steel production remained at the same low level, whereas domestic consumption rose owing to an increased demand in the post-conflict reconstruction boom.

In the immediate future steel consumption is expected to be between 7 and 10 million tons per year. Considering the existing gap between domestic production and the consumption estimates, it is evident that Government affords top priority to the development of the iron and steel industry and the heavy industrial sector.

The Government is in the process of increasing domestic steel-making capacity by putting on stream two new steel plants producing directly reduced sponge iron from iron ore pellets by gaseous direct reduction processes followed by metal transformation and metal work shops.

The plants at Ahwaz and Mobarakeh are already in the phase of commissioning and construction, respectively. Together these plants are expected to produce approximately 5 million tons of steel per year. Unlike the Esfahan plant, the two new reduction plants will utilize the most modern European-type technology.

Similarly, in the post-war reconstruction programme, increasing aluminum production has become another priority of the industrial sector. In particular, Government priority has been given to the aluminum production of the Arak plant and to the development of the aluminium downstream industries in and around the city of Arak. The pre-war capacity amounted to 45,000 tons per annum, but during the conflict the Arak plant was repaired and rehabilitated on several occasions so that by 1988 annual capacity had increased to 70,000 tons per annum. Further planned expansions of the plant will bring its annual production level to about 120,000 tons, sufficient for domestic demand.

The importance of aluminum production is underscored by the fact that the Government has decided to build a second aluminum smelter, which at a yearly capacity of 230,000 tons will become operational in 1994 at an estimated cost of $1,250 million.

Development and growth of other sectors within the heavy industry sector do not predict a similar pattern to iron, steel and aluminium. During the period of the conflict, the main priority of industries directly damaged was to repair and rehabilitate them as quickly as possible. With the exception of four plants located in the Abadan area that were completely destroyed, all other plants could be repaired.

The immediate and often improvised repair, necessary to maintain industrial output, resulted, however, in some major problems with long-lasting effect, the greatest handicap being the existing technology gap created by eight years of war. In order to reach the level of present-day technology and thereby make Iranian industry competitive, huge investments will be required.

(c) Implementation of reconstruction programme

Rehabilitation in the heavy industry sector in the post-war period has resulted in a marked increase in output compared to that of 1980. This expansion of capacities is shown in the table below.

	1980	1990	1992	1994
Iron and steel (million tons)	1.5	2.0	6.0	7.0
Primary aluminum (thousands of tons)	45	70	90	350

The status of implementation in the heavy industry can be illustrated by the following figures:

Throughout the war period, the Government spent Rls 16,000 million on the repair and reconstruction of damaged plants. The total expenditures on immediate rehabilitation, often carried out in the form of "band-aid work" of the inspected plants is estimated by the mission at Rls 90,000 million. However, if there had been a full-scale rehabilitation with adequate equipment replacement, including the incorporation of technological updates, the amount required would have been about Rls 200,000 million (according to Government estimates).

To sum up, the mission concludes that reconstruction in the narrower sense has been achieved and can be considered complete as nearly all factories are producing again. For the few not yet operational, the only need is finance.

(d) The role of the private sector

At present, the metal-producing industry is entirely Government owned. As to the capital stock, three quarters of the remainder of the heavy industry is under Government control, representing about 15 per cent of the number of units. In an effort to make factories more profitable, the Government has agreed to make a change in its policies by encouraging the private sector to participate. The Government is actively promoting joint ventures with participation of foreign companies for new investment so as to obtain the needed technology and capital. In the transfer of ownership to the people the Tehran stock market will play a key role. Some companies have already been traded on the stock exchange, and preparations are being made to continue with this promising process.

The mission was informed that in the future private sector involvement in the heavy industry, including the metallurgical sector, would be the main participant in the task of rebuilding the country's industry. Under this

scenario, the long-term policy foresees a fast expansion of the private sector, while the Government's inputs will be confined to strategic areas of the sector.

(e) Major sectoral constraints

The mission has on file a summary of the observations made on 12 inspected sites in the heavy industry sector. The sector suffers from lack of finance, outdated technology, some manpower shortages, especially at the advanced technical skill level, and, in certain instances from non-utilization of available domestic raw materials.

While access to private investment may positively affect the replacement of equipment and further lead to the introduction of new technological elements, the upgrading of the skill level will be a problem that may have a long-lasting impact on the overall development of the sector. It is therefore necessary to expose technical staff to new technologies in other countries by means of study tours and short-term assignments to modern factories abroad; further, the strengthening of existing national institutional facilities and the building up of additional vocational centres should occur as soon as possible.

As to the better and more frequent use of domestic raw materials it will be necessary to revive the affected mines (bauxite, alunite, nepheline, etc.) with large sums of investment. During the years of the conflict practically no investments took place and raw materials, although available domestically, had to be imported from abroad in order to keep heavy industry running.

(f) Expressed need for international assistance

The Islamic Republic of Iran is embarking on very ambitious programmes for the intensive exploitation of its energy and in future of its mineral resources. The Government has further taken decisive steps in the post-conflict years to set up modern metallurgical industry covering iron and steel production from sponge iron.

At the same time, it is well known that the country during the past decade had only very limited access to high-tech developments. The generation of engineers that was trained during the 1980s had only limited opportunities periodically to upgrade their technical knowledge and to keep abreast with the state of the art in their field of activities.

Considering that thousands of new jobs, requiring high level skills, will be created in the reconstruction of the new steel industry, and that the profitability of these enterprises will very much depend on the skills of their engineers and technicians, the creation of higher technical and vocational training programmes for technicians and managers is a priority.

Moreover, research and development facilities at the plant level are often poorly equipped, sparsely funded and, in certain instances, not existent at all. It is, therefore, especially important that the international community provide technical assistance in the form of highly specialized, short-term advisory services with emphasis inter alia on proposing research and development programmes or identification of technology and equipment. At a less advanced level, vocational training courses could be co-hosted with relevant multilateral or bilateral agencies.

Another area where some assistance from abroad is needed relates to the huge amount of scrap steel resulting from the conflict. The setting up of mobile smelters in the war-stricken regions could lead to producing a revenue-generating product that could be used either domestically or abroad. The scrap removal activity, both steel and construction material, will not only be a major input, but also a precondition in the country's efforts to reconstruct the strategically located cities of Abadan and Khorramshahr.

The mission inspected the 12 following sites in the heavy industry sector. Notes made at the time of the visits are on file.

Iranian Aluminium Company (IRALCO), Arak

Asco-Ahwaz Steel Complex, Ahwaz

Pars Wagon Co., Arak

Azar Ab Industries Co., Arak

Hepco Company, Arak

Machine SE

Khuzestan Pipe Manufacturing Co., Ahwaz

Sepanta Industrial Company, Ahwaz

Ahwaz Rolling and Pipe Mills Company (ARPCO), Ahwaz

Kaavian Steel Co., Ahwaz

Shahid Soltani Industrial Company, Ahwaz

Iran National Steel Industrial Group (INSIG), Ahwaz

2. Light industry

(a) Overview of damage

While the mission found clear evidence that the light industry sector suffered greatly from the conflict, the Government was unable to provide a comprehensive damage estimate. This is explained by the fact that the light industry sector comprises predominantly small- and medium-scale private enterprises with relatively few channels of contacts with the Ministry. Moreover, most repair work was initiated and financed from private sources. Some estimates on damage following on-site inspections carried out during the

first visit of the United Nations team has been provided in the report of the mission (S/22863).

Briefly stated, the team observed that the industrial sector had sustained considerable damage varying among individual companies from moderate to total destruction and that the total value of the losses had been significantly raised owing to the frequently encountered cycle of repeated attacks and repairs of the same installation.

Although the plants are back to what at least superficially looks like normal operation, physical traces of the damages are visible everywhere, and most factories continue to suffer from the lack of spare parts, maintenance facilities and backup services and from the consequences of makeshift reconstruction and repair work.

(b) Government priorities and plan-targets

Government reconstruction policy

The fundamental priority established by the Government for the reconstruction process is the earliest resettlement of the displaced population, preferably in the areas originally occupied. The most basic requirements that have to be met for this process to succeed are housing, infrastructure and employment opportunities. Industrial rehabilitation responds to all three requirements and has therefore received correspondingly high priority in the context of the overall reconstruction process.

Reconstruction policies with respect to industry

The mission has not become aware of any comprehensive or structured reconstruction plan for the industrial sector. But this does not mean that the process has in any way been delayed. In keeping with the traditional dynamism of the predominantly privately owned industry it was, in fact, able to lead the way for many other sectors of the economy.

Since the early stages of the conflict, when industrial plants and small-scale manufacturing units first became the targets of enemy attacks, the overriding objective of the Government has been to maintain or resume at least a minimum production process without exposing the personnel to excessive danger. Physical reconstruction of basic production facilities, within the limitations set by available parts and materials or funds for their procurement, was thus an important target throughout the conflict.

Since the cease-fire the all-important objective has been to bring the industry back to its full production capacity, or at least the level achieved before the war, and very considerable financial resources have been made available by the Government for this purpose, backed by a decentralized system for their allocation to the individual production units. The initial emphasis has been on increasing the output through direct replacement of lost or

damaged equipment and parts rather than on improving productivity, technology and product quality.

In respect of funds allocation from Government funds earmarked for reconstruction purposes under the control of the Ministry of Industry, priority has been and continues to be given to so-called strategic products including food, building materials and inputs to other strategic sectors.

The responsibility for the allocation of Government grants to small-scale industries and handicraft units has been delegated to the Directors of Industry in each of the affected provinces, who approve the applications for financial support on the basis of an analysis of local needs for the product(s) in question.

At the plant level clear priority has been given to the rehabilitation of the most essential production equipment allowing the performance at first of a basic production process, while the establishment of auxiliary facilities such as maintenance and repair workshops, stand-by generators, safety equipment and administrative buildings in many cases has been left pending until today.

(c) The role of the private sector

About 80 per cent of the light industry sector is in the hands of the private sector and, as a consequence of the Government's privatization policy, the figure is increasing. From this background alone it is obvious that the private sector has played a leading role in the reconstruction process.

Older and financially well established privately owned plants such as the Bisotoon Sugar Refinery were able to auto finance the complete reconstruction process without going through the procedures of applying for Government grants or bank credits. Consequently, they could, all other factors being equal, reach full production level within a minimum time-frame, a significant contribution in itself and an inspiring example for other factories.

In the war zone itself where most small- and medium-scale units were privately owned, the total devastation of their property must have been a violent blow to the entrepreneurs. However, the programme designed by the Government to facilitate their earliest possible return to the area, initiated only in 1989, when the zone became safe to re-enter, is now unfolding and apparently proving to be a success.

Private entrepreneurs are responding to the Government's offer of financial support in the form of grants, to permit the rehabilitation of the production units without further delay. Although the area is still in an initial state of post-war recovery they appreciate the scope for financially viable production activities and are now in ever-increasing numbers taking hold of their previous property and of its reconstruction.

They form the spearhead of the return of economic activity to the area, already followed by government-owned factories such as the oxygen plant and the paint manufacture at Abadan, which are in the process of reconstructing, benefiting from the same type of government grants as the private industry.

Also new private entrepreneurs are following the footsteps of those previously located in the area. They are following the Government's call for new industrial initiatives in the area and are accepting the challenge of setting up pioneering industries such as processed meat, fish powder, plastic tubing and textiles in two industrial parks now being created at Abadan and Khorramshahr.

The Government's belief in the competence of the private sector and the advantages of involving it as closely as possible in the reconstruction process is very visibly brought to bear by the assignment of the responsibility for preparing a five-year reconstruction plan for the Abadan-Khorramshahr area to a private company.

(d) General industrialization policies with bearing on reconstruction

Obviously, the reconstruction of manufacturing units has been and continues to be guided by a set of other priorities and basic principles which are common for the entire industrial sector. These include:

Employment generation, the principle of securing a safe work place for all, especially important for the revitalization of the war-stricken provinces through the return of their former inhabitants;

Privatization, a policy recently given new emphasis by the Government following the end of the centralized wartime economy and intended to favour private ownership of present and new production units by the entrepreneur himself or by shareholders;

Environmental protection is given top priority by the Government, as recently stated at the United Nations Industrial Development Organization (UNIDO) Conference on Ecologically Sustainable Industrial Development, and appropriate regulations are being reinforced also in the context of the reconstruction effort;

Industrial estates, of which 80 already have been established across the nation and which facilitate the creation or relocation of artisanal units and small-scale industries and contribute towards both cost-effectiveness and better environmental control;

Safe construction methods, especially in respect of the earthquake resistance of factory buildings and workshops, achieved through requirement of compliance with existing building codes for government-subsidized construction.

(e) The reconstruction effort

Except for the areas where actual ground fighting took place, most craftsmen have returned to their workshops and practically all medium- and large-scale industries have reached approximately the output achieved before the war with further growth indicated for the next few years. In Khorramshahr all but a few of the mechanized production units are still in ruins, but in many cases plans for their reconstruction are well advanced.

No relocation of any significance has taken place except in the case of small craftsmen (tailors, bakers, welders, etc.) who are mobile and require little or no capital investment and who in some cases have preferred to remain in their new home area. Incentives are, however, being offered to attract as many as possible to the previous war zones.

The only noteworthy case of organized relocation is that of some 35 brick makers from Qasr-e-Shirin in Bakhtaran Province whose production units had been demolished by explosive devices and who are now being regrouped in three larger brick-making enterprises under construction nearby.

The rehabilitation process has not been noticeably hampered by shortage of manpower. Most workers have returned and additional personnel has been easily available except in devastated areas such as Khorramshahr, where skilled workers for the newly rehabilitated soap plant had to be brought from Tehran.

At the technical management level the process has been characterized by a lack of awareness of up-to-date technologies, which makes the exposure of senior staff to the newest developments in their field a must for further growth of their enterprises. Mechanical skills and abilities to improvise and solve maintenance and repair problems by available means have, on the other hand, been developed to impressive levels during the past 10 years.

Although rehabilitation has brought production up to pre-war levels, the situation is far from satisfactory. Owing to lack of funds, including government grants in rials but especially convertible currency in general, reconstruction of production lines has often stopped at a bare minimum. Even major plants (for instance Dorud Cement Factory and Pars Paper Factory) are without stand-by generators, proper maintenance facilities, adequate spare part stores, etc. Urgent rectification of this situation which, no doubt, requires considerable amounts of additional foreign capital, is called for to avoid serious future work stoppages.

Due to the urgency of reconstruction, the general lack of funding, especially convertible, and to some extent the unawareness of technological developments which have taken place over the last 10 to 15 years, reconstructed factories have not improved their technological efficiency over the pre-war level. Except for the totally destroyed industries located in the areas abandoned from 1980 to 1989 owing to ground fighting for which reconstruction plans only now are taking shape, most production lines

operating today consist of the original equipment, repaired as well as it was possible, and supplemented as required with new equipment representing only slight improvements over the originals.

Examples of reconstruction scenarios

As a follow-up to the work of the first team during May and June 1991, which focused primarily on a survey of the damage sustained, this mission concentrated its attention on the past, present and future reconstruction effort. In an attempt to collect as many first hand data as possible within the limited time available, the mission spent three days in Khuzestan Province, where the following 17 units belonging to the light industry sector were visited:

Karun Sugar Refinery, Shushtar

Karun Animal Feed Plant, Shushtar

Haft Tappeh Sugar Refinery, Shush

Pars Paper Factory, Shush

Dezful Sugar Refinery, Dezful

FARCIT Asbestos Cement Plant, Ahwaz

Behterin Fibre Board Factory, Khorramshahr

Stone crushing plants, Khorramshahr

Ahmadian Stone Cutting Plant, Khorramshahr

Zarea Ice Making Plant, Khorramshahr

Gerald Date Packaging Plant, Khorramshahr

Nik-Noosh Soft Drink Plant, Khorramshahr

Khorramshahr Soap Factory, Khorramshahr

Abadan Grand Cooling Store, Abadan

Arvandan Shipbuilding Company, Abadan

Khuzestan Sterilized Milk Company, Abadan

Pazargad Chemical Company, Abadan

Owing to limited time, and considering the fact that the previous mission had carried out an extensive programme of field visits, no other plants were inspected by the present mission. The picture of the reconstruction process in the light industry sector was, however, completed through meetings at Tehran with senior representatives of the following additional enterprises:

Dorud Cement Plant, Lorestan

Western Cement Company, Bakhtaran

Bakhtaran Spinning Mill, Bakhtaran

Bisotoon Sugar Refinery, Bakhtaran

These units, which represent a cross-section of the sector, are described in some detail in appendix I, which in addition to basic data on each plant presents its war history as well as its rehabilitation history. For the purpose of providing a clearer overview of what happened in this sector and of the situation it faces today, the following examples have been extracted.

Medium- and large-scale plants outside the zone of ground fighting

This category includes, among the plants visited, not only Karun Sugar Refinery, Haft Tappeh Sugar Refinery and Pars Paper Plant, but also the four factories in Bakhtaran and Lorestan Provinces, which were not visited during this mission, fall within this category.

Typically, they are privately owned industries established before the Revolution, employing between 1,000 and 3,000 persons and processing locally available raw materials such as sugar cane, beet root, bagasse (cane waste) and limestone. The existence of these raw materials and the availability of cheap energy have determined their location.

During the war they were attacked repeatedly through aerial bombardment directed with relative accuracy towards vulnerable and strategic targets including power stations, generators, transformers and other electrical installations as well as spare part and product stores, maintenance workshops, etc. but, obviously, hitting a host of other targets as well. Most air raids were flown against these plants between 1985 and 1987.

Repair was carried out on a continuous basis after each attack and production was only rarely interrupted for more than a few weeks and seems to have remained at around or even above 50 per cent of the pre-war output level on a yearly basis throughout the war period.

This excellent performance was achieved mainly thanks to the ingenuity and improvisational talents of the staff, who managed to keep the production going with makeshift repairs, first using the plants' own stock of spare parts and later by cannibalizing their own machines to keep other equipment going or by obtaining parts from other factories in the country.

Following the end of hostilities, the reconstruction work continued with as much emphasis on the replacement of damaged equipment and parts with original imported items as the availability of foreign exchange would allow. By 1990, or latest by 1991, these factories were, typically, back to the pre-war production volume averaging some 60 to 70 per cent of installed capacity.

The situation of most of these plants is, however, precarious since the procurement of spare parts and the rehabilitation of vital backup services such as maintenance and repair facilities, stand-by generators and control mechanisms has been awarded too low a priority to allow even modest requirements to be satisfied.

Equally serious is the general obsolescence of the production technologies, which were behind international standards for the industry even before the war started and have not been significantly updated in the course of reconstruction. The earlier this problem is seriously addressed, the better.

Larger plants in the actual zone of ground fighting

Only few larger industries were based in the zone along the border, which was turned into a theatre of intense ground battles. They were mostly located in the Abadan and Khorramshahr area, where the vicinity of the Abadan and Khorramshahr harbours and the Abadan refinery provided a fertile environment for industrial growth. The Avadandan Ship Building Company, the Khuzestan Sterilized Milk Company and the Pazargad Chemical Company are the industries among those visited by this mission that fall into this category.

Similarly to the larger industries elsewhere, they were established before the Revolution. However, in other respects their background is different since they are justified more by the needs for their products, especially by the public and defence sectors, than by availability of inputs. Consequently, they are predominantly owned by the public sector or under public sector control.

Given their location in the initial war zone, they were abandoned and occupied by Iraqi forces during the period from 1980 to 1982 and left in a state of considerable destruction. The dairy was left in this state until the area was again safe in 1989, as were most other installations in the area. Starting from 1982-1983, the two other plants engaged in building military vessels and producing strategically important chemicals were already reconstructed and put back into operation under most trying conditions for the staff.

Before the cease-fire they were both back in full operation and have remained so ever since. The shipyard has even expanded its production and the dairy, which is now in the midst of a dynamic reconstruction programme, is aiming for an output four times the installed capacity before the war.

Small-scale production units in the zone of ground fighting

All six units are privately owned and manufacture products or perform services required in the area. They were all totally destroyed during the period of occupation and left in ruins until the owners could return in 1989.

They have all applied for and are in the process of receiving government grants covering the total cost of reconstruction, in rials as well as convertible currency, and will soon be back to full operation as before the war but on a more modern technological level.

They will once more be contributing towards improving the quality of life and strengthening the economic activity of the area and in this respect play a significant role in the overall reconstruction of the previous war zone.

A similar contribution will be made by larger, private industries in the area, including the Khorramshahr Soap Factory and the Nik-Noosh Soft Drink Plant, which have experienced a comparable pattern of occupation, destruction and abandonment and are now in the process of reaching their pre-war capacities with strong support of the Government.

As stated to the mission by the Minister of Industry, the start of production of the Khorramshahr Soap Factory, soon to be followed by several others, is "a light in the dark" giving new hope for this devastated area.

(f) Achievement of priorities and targets

As demonstrated by the above scenarios, no effort has been spared in order to complete the reconstruction process in the shortest possible time.

The priority given to the promotion of the return of private entrepreneurs to the area of ground fighting in an effort to revitalize the zone along the border and the incentives offered in order to achieve this aim are proving to be successful.

Where reconstruction could be initiated before the cease-fire, production is now on average at par with or exceeding the level reached before the war. In the more severely affected areas where reconstruction has only recently begun, there are promising signs that pre-war output levels will be reached by 1993.

However, from the examples given it is evident that progress towards full rehabilitation of all damaged industrial plants, especially in terms of secondary functions and investments, which have only minor immediate effect on productivity, has been slowed down or temporarily halted owing to lack of funds. The Government is aware of this problem and endeavouring to find ways to overcome it.

(g) Contribution of industry to reconstruction in other sectors

Reconstruction of the industrial sector goes well beyond the rehabilitation of enterprises existing before the war. It also means strengthening the industries which are needed for reconstruction in other sectors, notably the resettlement of the largest possible part of refugees and other displaced persons.

Industry provides the major part of the building materials needed for new or reconstructed housing and necessary infrastructure, including schools and other public buildings, which are an important prerequisite for the return of the population and, at the same time, provide employment opportunities, both in the building materials and other sectors.

There are therefore strong arguments for promoting the establishment of new building material industries in the war-stricken areas and to qualify this sub-sectoral activity as an integral part of the overall reconstruction effort.

Particularly small-scale enterprises, conceived so as to make optimum use of strictly locally available raw material resources and to produce for construction in the vicinity of the unit, would not only make a valuable contribution towards improving the population's access to appropriate materials but would also, by reducing the transport routes for raw material inputs and finished products, lead to an appreciable reduction of the cost of the materials and, in turn, of the buildings themselves.

(h) Role of the international community

As described in the preceding paragraphs, the reconstruction process is well advanced in the light industry sector, and the efforts which remain in order to bring the situation back to the pre-war status are with only few exceptions blocked primarily by the lack of resources, in particular foreign currency.

In the view of the mission, a complete rehabilitation process also requires that the technology gap created as a consequence of the war be somehow bridged. For 10 years or more the technology transfer flow was virtually interrupted, and in any case the efforts of most industries were focused on keeping a basic production process going rather than on technological innovations.

The international community could without much delay and at a minimal cost assist in bridging this gap by facilitating the contacts between Iranian industry and relevant technology holders abroad.

Skill development

There is an urgent need for industrial managers to become acquainted with the technological developments which have taken place at the international level in their field of specialization during these years and to become aware of areas in which their plants could benefit from these developments, even at this stage.

The mission has even met a number of high-level technical staff of major production plants who have never seen similar factories outside the country and therefore do not even have a basis for the assessment of their own plant's technological level and efficiency. Even though they have reached an admirable level of proficiency, especially in mechanical repair and trouble-shooting through trial end error, there is no doubt that their performance could be significantly enhanced through just a brief exposure to the technological situation outside the country.

Technological information services

Lack of or delays in technological innovation is often a result of unawareness of the available options. The sectoral advisory units existing in the Ministry of Industry and the relevant national institutions, including the

scientific advisory council in which both industries and universities are represented, should be invited to establish closer links to existing technological data bases abroad.

They would be able to act as an open window to international technologies and provide authoritative advice to industries seeking new technological options.

Investment promotion

The reconstruction process could be completed earlier and more efficiently and at lesser cost to the national economy if foreign joint ventures were more vigorously pursued. Potential partners would include equipment and technology suppliers as well as manufacturers of similar product lines. The international community, including organizations such as UNIDO, has extensive experience in bringing partners together and assisting in the contract negotiations and should be called upon to contribute to the reconstruction process in this respect.

E. AGRICULTURE AND IRRIGATION

1. Institutional framework

Development activities in the agriculture sector fall mainly within the purview of three Ministries, the Ministry of Agriculture, the Ministry of Energy and the Ministry of Construction Jehad.

The Ministry of Agriculture is responsible for crop production, on-farm irrigation and drainage, agro-industries and agricultural support services such as research, extension, training, etc.

The Ministry of Energy is responsible for mobilization of water resources through construction, operation and maintenance of storage, diversion and lift irrigation facilities as well as conveyance of water through main canals and branches. The distribution and on-farm application of water are the responsibility of the Ministry of Agriculture.

The Ministry of Construction Jehad is responsible for the development and conservation of forests and pastures, fisheries, livestock and date palm plantations. Other related agencies concerned with these subsectors are the Environmental Protection Organization, the Organization of Nomadic Affairs, etc.

2. War damage

Agriculture is reported by the Government to have suffered direct losses estimated at Rls 1,783,377 million and indirect losses estimated at Rls 14,173,953 million. 1/ The farming subsector sustained the bulk (86 per cent) of the direct losses whereas 97 per cent of the total indirect losses are attributed to the forestry subsector.

3. Reconstruction

(a) Priorities

While the entire reconstruction programme is accorded the highest priority by the Government, the relative order of priorities for the various subsectors, as indicated to the mission in the various meetings with the Ministry of Agriculture, are outlined below:

Farming

- Land levelling and grading
- Restoration of irrigation network

- Replacement of farm machinery and pumping equipment

- Replanting of date palm and orchards

- Reestablishment of farm support services

Livestock and agro-industries

- Replacement of animals to resettled farm families

- Reconstruction of dairy, sugar and other agro-industries

Forests, pastures and environmental protection

- Replanting of forests

- Rehabilitation of pastures

- Waterlogging and salinization of land

(b) Progress and programme

As envisaged during the visit of the June 1991 mission, the present mission also concentrated on evaluating the progress and programme of reconstruction works in the three most affected provinces: Khuzestan, Ilam and Bakhtaran. Owing to difficulties of travel and shortage of time, the mission was able to visit only the Provincial Departments of Agriculture in Khuzestan and Bakhtaran accompanied by a representative of the Ministry of Agriculture. Data relating to Ilam were furnished by the Provincial Agricultural Department and necessary clarifications were obtained by the mission over the telephone. Data relating to water resources were furnished at Tehran by the Ministry of Energy. A detailed breakdown on reconstruction costs for these three provinces has been placed on record.

Water resources

The areas affected by the conflict relating to the water resources for agriculture, administered by the General Directorate of Water Resources in the Ministry of Energy, are divided into the three regions shown below:

- The West Water Authority Region, comprising the provinces of Ilam, Bakhtaran, Kurdistan, Loristan and Hamedan.

- The province of Khuzestan.

- The province of West Azarbayjan.

The total scope of reconstruction work involved in rehabilitating the damaged diversion structures, pump stations, main canals and other ancillary works is outlined in table E.4. The extent of work completed to the end of 1991 and the schedule for completion during the remaining two years of the ongoing first five-year plan period (1992 and 1993) and during the second five-year plan (1994-1999) are summarized in table E.1 below:

Table E.1. Reconstruction work in water resources

	Quantity completed to end 1991	Scheduled 1992-1993 (Percentage)	Scheduled 1994-1999
Diversion works 126 Nos.	27	20	53
Pump stations 242 Nos.	15	15	70
Irrigation canals 1674 km	16	14	70
Access roads 450 km	50	40	10
Camp sites 2 Nos.	20	20	40
Hydromet stations 185 Nos.	-	10	90

Agriculture

Farmland rehabilitation

Large areas of irrigated and rain-fed farmlands suffered total destruction as a consequence of military manoeuvre of heavy equipment and vehicles, the construction of an enormous amount of revetments and vast stretches of high embankments, trenches and underground tunnels. Rehabilitation of these areas requires intensive land levelling, grading and formation of basins or border strips for irrigation. The average volume of earth required to be moved for rough levelling of rain-fed areas amounts to more than 500 cubic metres per hectare (m3/ha). For levelling and grading of irrigated farmlands, the volumes of earth to be moved range from an average of 1,000 m3/ha in the plains of Khuzestan to between 1,500 m3/ha and 2,500 m3/ha in the undulating lands of Ilam and Bakhtaran for basin and border irrigation respectively.

The equipment used for land levelling and grading comprises mainly heavy duty scrapers, bulldozers and graders, including loaders, trucks and personnel transport. Much of the earth-moving equipment is reported to have outlived its mechanical life, some being more than 10 years old. However, replacement or major overhaul of such equipment is hampered by resource constraints. At the time of the mission's visit, about 70 scraper units were employed on land-levelling operations in Khuzestan. In Bakhtaran, the number of available

units (scrapers, bulldozers and graders) had fallen recently from 53 to 12 owing to recall of the units which had been temporarily loaned by other provinces/agencies. The land-levelling capacity of the remaining equipment is reduced to about 400 ha per year, which highlights the need for provision of additional earth-moving equipment to Bakhtaran province, where some 35,000 ha of irrigated farmlands await rehabilitation.

The total scope of land levelling, the extent completed to the end of 1991 and the schedule for completion during the remaining two years of the ongoing first five-year-plan period (1992 and 1993) and during the second five-year plan (1994-1999) are shown below:

Table E.2. Rehabilitation of farmland

	Quantity	Completed to end-1991	Scheduled 1992-1993 (Percentage)	Scheduled 1994-1999
(a) Land levelling and grading of irrigated farmlands				
Khuzestan	193 425 ha	50	30	20
Ilam	12 500 ha	40	5	55
Bakhtaran	45 000 ha	22	15	63
Total	250 925 ha	44	26	30
(b) Land levelling (rough) of rain-fed areas				
Khuzestan	1 700 ha	50	30	20
Ilam	40 500 ha	50	10	40
Bakhtaran	11 500 ha	100	-	-
Total	53 700 ha	61	8	31

Irrigation network reconstruction

The rehabilitated lands are to be equipped with a modern network of distribution canals which are designed for varying discharges of up to 1 cubic metre per second (m3/s). These canals are proposed to be provided with concrete lining in order to minimize seepage losses which are reported to be causing progressive increase of waterlogging and salinization of the irrigated lands. There is also a network of drainage channels which is to be provided over the regraded lands or rehabilitated over other irrigated lands.

In addition, there are a large number of traditional canals, often drawing water by diversion or pumping directly from rivers, which need major rehabilitation as a result of the damage caused by military action and neglect suffered during the eight years of conflict. In Dasht Azadgan area of Khuzestan, there are 7 major traditional canals with discharges ranging from 20 to 37 m3/s while the largest canal (Hofel) is 38 kilometres long, with discharge capacity of 110 m3/s. On the whole, the large traditional canals, accounting for about 20 per cent of the total, may have discharge capacities ranging from 3 to 4 m3/s; about 50 per cent are of medium size with discharge of 0.5 to 1.5 m3/s; and the remaining 30 per cent are small channels with capacities less than 0.5 m3/s.

The following table shows the total scope of irrigation and drainage canals reconstruction work, the extent completed to the end of 1991 and the schedule for completion during the remaining two years of the ongoing first five-year-plan period (1992 and 1993) and during the second five-year plan (1994-1999):

Table E.3. Reconstruction work in irrigation

	Quantity	Completed to end-1991	Scheduled 1992-1993	Scheduled 1994-1999
		(Percentage)		
(a) Modern canal network (distributaries and sub-distributaries on rehabilitated lands				
Khuzestan	7 342 km	50	30	20
Ilam	74 km	10	13	77
Bakhtaran	1 125 km	22	15	63
Total	8 541 km	46	28	26
(b) Traditional canals				
Khuzestan	244 km	0	20	80
Ilam	21 km	17	18	65
Bakhtaran	1 050 km	43	27	30
Total	1 315 km	35	26	39
(c) Drainage channels				
Khuzestan	5 850 km	20	20	60
Ilam	50 km	0	20	80
Bakhtaran	110 km	100	-	-
Total	6 010 km	21	19	60

Lift irrigation

A large number of pumping equipment in the affected provinces for lift irrigation from rivers and canals, have been destroyed or looted during the conflict. These pumping stations comprised government-owned large units ranging in size from 150 to 350 HP and privately owned smaller units averaging 35 HP units. In addition, 258 deep tubewells in the northern Ahwaz (Shush and Dezful) area of Khuzestan and about 200 tubewells in Ilam, used for exploiting groundwater for irrigation, were destroyed to varying degrees.

The total requirement of pumping equipment to be replaced and tubewells to be rehabilitated, the extent completed to the end of 1991 and the schedule for completion during the remaining two years of the ongoing first five-year plan period (1992 and 1993) and during the second five-year plan (1994-1999) are shown below:

Table E.4. Reconstruction in lift irrigation

	Quantity	Completed to end-1991	Scheduled 1992-1993 (Percentage)	Scheduled 1994-1999
(a) Pumping stations				
Ilam				
160-270 HP	15	10	40	50
Bakhtaran				
350 HP	32	0	20	80
5-65 HP	300	0	20	80
(b) Tubewells				
Khuzestan	258	75	25	-
Ilam	195	5	20	75
Total	800	26	22	54

Farm machinery

The farm machinery available to the affected areas for agricultural purposes ranged from 0.5 HP to 0.7 HP per hectare, which was completely destroyed or looted during the conflict. The Agricultural Departments believe that, but for the hiatus caused by the eight years of conflict, the level of mechanization in the affected areas would have reached at least 1.0 HP/ha. Hence, the farmers being resettled in the rehabilitated areas are to be equipped with farm machinery, mainly as 65 HP tractor units, at the rate of about 1.0 HP/ha.

The total requirement of farm machinery, the extent provided to the end of 1991 and the schedule for completion during the remaining two years of the ongoing first five-year plan period (1992 and 1993) and during the second five-year plan (1994-1999) are shown below:

Table E.5. Replacement of farm machinery

	Quantity	Completed to end-1991 (Percentage)	Scheduled 1992-1993 (Percentage)	Scheduled 1994-1999 (Percentage)
Khuzestan	193 500 HP	16	14	70
Ilam	53 000 HP	30	40	30
Bakhtaran	72 200 HP	15	25	60
Total	318 700 HP	18	21	61

Replanting tree crops

As reported by the first mission, more than 3 million of the 7 million date palm trees that were under production in Khuzestan have been destroyed, mainly in the Khorramshahr, Abadan and Shalamcheh areas. In addition, orchards covering areas of about 400 ha in Ilam and 4,730 ha in Bakhtaran were reported destroyed. The progress of replanting the destroyed tree crops is hampered, among other things, by the limitations on the production of saplings from available facilities. In general, about 15 to 20 per cent of the tree crops are reported 2/ to have been replanted to date, and the remaining are planned to be completed by the end of the second five-year-plan period (1999).

Farm support buildings

Farm support buildings covering a total area of about 48,000 square metres, along with their equipments and materials were destroyed in Qasr-e-Shirin, Korsay and other parts of Khuzestan province. Similarly, about 15,800 square metres of farm support buildings were destroyed in Ilam province. Reconstruction of these buildings has progressed to varying degrees, with overall completion estimated at about 40 per cent in both provinces. Details of progress on various types of facilities in Khuzestan are shown below:

Table E.6. Reconstruction of farm support buildings

Type of facility	No. of units	Percentage completed
Extension Centre	8	50
Input Supply Warehouses	12	25
Agric. Research Centre	1	10
District Agric. Offices	10	50
Quarantine Units	6	0

Reconstruction of the farm support buildings is planned to be completed during the next five years.

Agro-industries

As reported by the first mission, considerable damage (including destruction of about 40 per cent of the machinery) had been inflicted upon the sugar mills at Haft Tappeh with annual capacity of 100,000 tons and at Karun with annual capacity of 250,000 tons in Ahwaz-Dezful region of Khuzestan. In June 1991, the production capacity of these mills had been restored to 80 per cent and 20 per cent, respectively, of their initial installed capacity. The mission was informed that reconstruction of the agro-industries was in progress, and initial arrangements were under way for reactivating the plans to establish seven more agro-industries in the region with land plots of 18,000 to 23,000 ha devoted to production of sugarcane for each unit.

Forestry, pastures and fisheries

As reported by the first mission, about 85,200 ha of natural forests were destroyed and 46,550 ha exploited for military reasons. Similarly, some 753,000 ha of pasture lands in the war zone were reported severely damaged as a result of military actions.

Losses reported in the fisheries subsector comprised 200 wooden vessels of 20 to 80 gross registered tons and 50 steel fishing vessels of 300 registered tons. A considerable number of cold storage facilities were also reported to be damaged.

The progress of replanting the forests and rehabilitating the pastures or reconstruction of the losses in the fisheries subsectors could not be ascertained owing to the inability of the mission to obtain the required data.

(c) Environmental impact

The adverse impact of the conflict on environmental aspects of the agricultural sector is seen by the Government to relate mainly to the following:

Effect on soil fertility due to:

Removal of topsoil caused by excavations for fortification/trenching;

Compaction effects of movement of heavy military equipment;

Flooding of agricultural lands for defence purposes leading to prolonged anaerobic conditions and biological sterility of the soil.

Waterlogging and soil salinization arising from:

Salinization of soils in estuary areas due to uncontrolled ingress of sea water through intake structures designed to draw river flows making use of tidal movements;

Flooding of traditional canals due to lack of control at diversion structures, resulting in frequent overtopping of canal banks and flooding of lands, causing rise in water table;

Drainage constraints caused by modifications in river flow regimes as a result of blockage by military debris, compounded by the consequent increase in rate of sedimentation in the river beds;

Interruption in the installation of drainage networks and the resultant delay by more than 10 years in commissioning the drainage systems, caused by diversion of earth-moving equipment from construction of drainage channels to defence;

Soil and water contamination attributed by the Government to the toxic material emanating from explosives and/or chemical and biological weapons and its ingress into soil, streamflows and groundwater.

The adverse impact on soil fertility due to displacement of top soil alone may be felt to varying degrees by much of the 300,000 ha of land earmarked for levelled and grading. The extent of the actual or potential increase in waterlogging and salinity owing to the effects of the war has not been assessed. It is reported that some 5,000 ha are affected in Khorramshahr-Abadan region alone of Khuzestan province. No specific studies are known to have been undertaken so far in assessing the suspected contamination of soil and water due to the war operations.

4. Constraints

The main constraint to completing the reconstruction programme on schedule is the paucity of foreign exchange resources to meet the cost of equipment, spare parts and materials required to be imported or assembled locally from imported components.

Because of the magnitude and the urgency of completing reconstruction works, the shortage of skilled manpower and the supporting facilities such as personnel transport and surveying equipment, etc., is also deemed to be a constraint to timely and successful implementation of the programme.

A physical constraint to land levelling is the presence of unidentified mine fields left over from the war operations. It is estimated that up to 20 per cent of the lands awaiting development may be affected by this constraint.

5. Expressed needs for external assistance

The most urgent need expressed by the Ministry of Agriculture for external assistance relates to the procurement of heavy earth-moving equipment, such as scrapers, bulldozers, graders, loaders and dump trucks along with spare parts for such equipment to be purchased as well as the equipment already available but not usable owing to the shortage of spare parts. In addition to the considerable need for farm machinery (about 250,000 HP), pumping and well-drilling equipment would be needed for rehabilitation of lift irrigation facilities, whereas steel, cement and civil engineering construction equipment would be needed for canal excavation, canal lining and construction of control structures, etc.

The General Directorate for Water Resources in the Ministry of Energy has enumerated the scope of external assistance deemed necessary for timely completion of the reconstruction programme. The list includes construction equipment for canals and structures, pumping plant, well-drilling equipment, steel and cement, as well as various technical implements and instruments pertaining to the reconstruction programme.

6. Observations and recommendations

In the mission's view, the extent of reconstruction already accomplished during the short span of time since the cessation of hostilities is an eloquent testimony of the will and determination of the Islamic Republic of Iran to overcome as soon as possible the disastrous consequences of the conflict on the agricultural sector of the national economy. It is hoped that this study will help in expediting the reconstruction efforts, with appropriate international assistance, as envisaged in paragraph 7 of Security Council resolution 598 (1987).

In view of the serious concern expressed by the Government on the growing menace of waterlogging and salinity, it would be appropriate to initiate a comprehensive study to examine the causes, extent and potential risks to the agriculture sector. The study should also examine the preventive or remedial measures which should be considered for adoption including the extent and type of cost-effective canal lining 3/ which is proposed, to be adopted on a large scale in the affected areas. The mission recommends that the Government consider including technical assistance in this regard in the list of expressed needs for international assistance.

The mission observed that there is considerable scope for adopting modern irrigation management practices aimed at more efficient use of irrigation supplies 4/ and increase in crop yields through introduction of demand based irrigation. Technical assistance may also be considered to undertake a programme of applied research, drawing upon a wealth of experience which has been generated in recent years in coordination with the Internation Irrigation Management Institute in Colombo, Sri Lanka. In-service training of agricultural extension staff in improved on-farm water management practices would also be required to transfer the results of the aforesaid research to the farm.

Notes

1/ "Final Report on the Assessment of the Economic Damages of the War imposed by Iraq on the Islamic Republic of Iran (1980-1988)", Plan and Budget Organization, 1991.

2/ Progress on replanting date palm in Khuzestan could not be ascertained owing to the inability of the mission to obtain the required data.

3/ Recent studies on canal lining works carried out in developing countries have shown that traditional design and construction methods are not effective in appreciably reducing seepage losses in the long term.

4/ Overall irrigation efficiency in several cases is reported at around 30 per cent, which can feasibly be increased to 50 per cent through improved irrigation management.

F. ENERGY AND POWER

1. Sectoral objectives

As a result of the conflict, the Ministry of Energy followed an approach in the implementation of its programme to address the specific reconstruction needs of the sector. In the immediate sectoral approach, emphasis is given to (a) restoring the production capacity of the power stations damaged in the war; (b) ensuring that the major transmission systems damaged in the war are capable of supplying the power requirements throughout the country; and (c) restoring to full capacity the local power supply networks in the devastated regions of Khuzestan, Ilam, Kordestan and Bakhtaran.

Concerning the long-term objectives of the sector, priority is allocated to: (a) the completion of the construction to permanent structures damaged during the conflict; (b) the implementation of the pre-war development plans regarding production, transmission and distribution (these plans were designed prior to the conflict, but owing to the war their implementation had been halted); and (c) the stocking-up of materials necessary to ensure that the electrical system is not disrupted.

Since the outbreak of the conflict the Ministry adopted a policy of giving priority to maintaining, at the best possible level, the restoration and distribution of damaged facilities. This was accomplished by using exclusively materials that could be made available domestically. By pursuing this approach the damaged power production facilities are now in most cases back to the pre-war production level. The main power transfer (transmission network) is now in operation with the exception of the war-damaged areas in the Khuzestan province. The distribution network in Khuzestan has so far only been partially restored and according to government estimates two years of reconstruction work will be required to repair the incurred damage.

Similarly, the distribution network in the western provinces of Ilam, Khorramshahr and Bakhtaran has also only been partially restored with an estimated two years of reconstruction work to be carried out to reach pre-war levels.

For the period 1990-1998, the Ministry of Energy has also prepared long-term development plans for the electrical production and transmission systems in order to incorporate present power requirements and a predicted growth in demand of 8 per cent for the period.

2. Reconstruction effort

Implementation of the progress of the reconstruction programme is presented below according to its three main components: generation, transmission and distribution.

Generation

All generation facilities which had been damaged during the war are back to serve the communities. However, in many instances only temporary repairs had been carried out with the main emphasis on restoring productive capacity. This patching-up approach has resulted in a certain loss of reliability. The Ministry estimated that up to the present approximately three quarters of the incurred damage to equipment has been permanently reconstructed in the generation sector.

Transmission

The main north-south and western transmission system which had been badly damaged during the conflict is more or less back to normal service. In some areas of Khuzestan and in the western region of Ilam, Khorrambad and Kordestan, supplies have still not been restored. It is estimated that about half of the transmission work is completed.

Distribution

Distribution systems were mainly damaged in the south-western province of Khuzestan, the western provinces of Khorramabad, Ilam and Bakhtaran. Lesser damage occurred in the north-western province of Azerbaijan. In addition to the above-mentioned distribution centres, materials and spare parts, held in bond in Khorramshahr for use in areas outside the war zone, were also destroyed in the conflict, estimated at Rs 12,100 million. Reconstruction work in the war-damaged provinces of Khuzestan, Ilam, Khorramabad and Kordestan is 30 per cent complete. In the case of Azerbayjan, it is estimated that only 20 per cent of reconstruction work has been completed.

3. Constraints

While the Ministry with its own local resources, human as well as financial, has performed to the best of its ability in the implementation of its reconstruction programme, it has, nevertheless, encountered a number of constraints. Some of the reconstruction programme experienced delays due to unavailability of equipment. In certain instances, equipment could not be obtained locally and subsequently, when ordering it from abroad time lags impeded reconstruction work. In addition, the purchase of equipment for reconstruction required allocation of foreign exchange which was, and continues to be, in short supply. Foreign exchange allocations are authorized by the Ministry of Finance on a case-by-case basis. Both factors, the imported equipment and the foreign exchange restrictions, caused lengthy delivery delays and hence retardation to the reconstruction work.

4. Privatization

The power sector is, with few exceptions, controlled by the Government. It consists of one major system stretching from the Persian Gulf to the Caspian Sea, two smaller systems in the north-east and in the south-east respectively, and several minor isolated systems located in the south-east based on diesel generators serving small villages in remote areas.

Major development plans, prepared prior to the war, could not be implemented, and normal developmental activities had to be replaced with wartime measures. Resources to war-affected areas were severely reduced and the rise in demand in other regions unaffected by the conflict could not be met. This shortage situation, although by now greatly improved, is still experienced through frequent interruptions to the power supply.

To overcome these problems the Ministry has reportedly awarded contracts to private companies to construct a further 9,000 MW of generating capacity and to expand the associated transmission facilities over the medium term (1990-1998).

In a further attempt to upgrade generation, transmission and distribution, the Government has indicated that the private sector could play an eminent role in this task. In support of this decision, the Ministry has, in principle, agreed to privatize the operation of regional electric companies as well as the operation of power-generating plants. However, the generation plants would remain under government ownership.

5. Nuclear power

The existing nuclear development programme is under the control of the Atomic Energy Organization in Tehran. The mission was informed that 2 x 1200 MW generating units were under construction at the start of the conflict. As a result of bombardment, both plants were severely damaged even before construction had been completed; at the time of destruction, one unit was 85 per cent complete, the second unit about 60 per cent complete. The mission was informed that neither the nuclear reactor nor nuclear fuel had been delivered.

6. Expressed needs for international assistance

The Government informed the mission that reconstruction and development in the power sector would necessitate international assistance in several areas. Some assistance would be required to upgrade the electrical system to acceptable standards comparable to those that could have been achieved if the conflict had not affected normal development. As a priority, the Ministry mentioned the reconstruction of electrical systems in the Khuzestan and Gharb provinces as a priority. This would require the purchase of foreign equipment, in particular, electrical transmission networks and substations.

It was also stated that there was considerable need for assistance in areas relating to management, planning and power systems design. As to equipment replaced and/or repaired during the time of the conflict, it was mentioned to the mission that some of the equipment would have to be replaced to ensure the efficient functioning of the system.

In both the water and power sectors, the Government emphasized the need for foreign assistance to improve present technology, including dam construction and modern control systems (computerization).

In the paragraphs that follow, a brief assessment is given of the power system at selected sites visited by the mission.

7. Principal power systems affected by the conflict

Interconnected system

The major interconnected electrical system is controlled by 14 regional companies, each of which plans and implements developments in their own area. However, the Department of Energy sets targets for the overall development of the power sector in the country; it further approves and monitors all major capital projects. Because of the war, the anticipated development had to be reduced to provide resources to the war-affected areas.

The major interconnected system of today has an installed generating capacity of 11,017 MW (megawatts) and a transmission system consisting of 400 KV (kilovolts), 230 KV, 132 KV and 66/63 KV systems. The demand for power decreased by about 50 per cent in the first year of the war. Thereafter the demand for power regained its pre-war level and subsequently the generating, transmission and distribution systems were substantially expanded. In fact the installed generating capacity almost doubled in the period 1980 to 1988. The generating system has four types of power plants - hydro, steam, gas turbine and diesel. The growth in capacity for each is illustrated in table F.1 below.

Table F.1. Power production capacity by government-controlled companies

Year	Hydro MW	Steam MW	Gas Turbine MW	Diesel MW	Private companies	Total MW
1980	1 804	3 983	3 058	783		9 628
1984	1 804	5 445	3 271	899		11 419
1988	1 904	5 981	2 935	705	2 865	14 390
1990	1 953	8 086	3 940	824	3 149	17 952

As seen in table F.2 below, the transmission system was also expanded by 100 per cent during the war years (1980-1988).

Table F.2

Year	400 KV KM	230 KV KM	132 KV KM	63/66 KV KM
1980	1 883	6 297	4 699	6 735
1984	4 318	8 266	5 605	11 732
1988	5 714	10 081	7 612	16 883
1990	5 618	10 970	8 532	18 202

The expansion of the distribution system during the war years was similar. In 1980 electric power was supplied to 7,800 villages and by 1990 electric power was supplied to about 24,000 villages; over 65 per cent of the rural population had been provided with electrical supplies. Details regarding the usage of power in the various sectors is set out in appendix III; the increase in numbers of consumers is shown in appendix IV.

Distribution

It was reported that significant damage was done to the distribution system in both the central and western regions, lesser damage in other areas, but that the greatest damage was done in the border provinces of Khuzestan, Bakhtaran, Kordestan and Ilam, which experienced ground fighting and prolonged occupation during the war.

Khuzestan

The south-western area of the Khuzestan province was reported to have been totally devastated. According to the regional electrical authority, several substations had been damaged on a number of occasions by repeated attacks. To restore supplies rapidly in the war-damaged zones, temporary networks were provided over extensive areas in this province. It was evident from on-site visits by the mission that, while major efforts had already been made to maintain power supplies to the consumers, significant reconstruction work remained to be done on the distribution system.

The mission inspected a number of substations in Abadan and Khorremshahr and witnessed areas where restoration of power supplies at this time was not feasible owing to war debris which had not yet been cleared. In addition, the mission witnessed areas where temporary supplies had been installed to provide power to consumers living in the surroundings of their damaged dwellings.

Abadan

In Abadan, the mission observed large areas where the distribution network had been reconstructed and upgraded using locally designed and constructed equipment. In addition, single circuit temporary supplies were also observed in this area.

It was observed that temporary repairs had been carried out only on several substations. It was reported that the main Abadan substation was destroyed in 1981 causing supplies to the area to be significantly reduced until 1988, when a temporary replacement transformer was installed in lieu of the two transformers which were destroyed during the war.

Khorramshahr

In several of the substations, it was noted that priority had been given to restoring power supplies from these stations by replacing only one transformer and connecting this to the transmission or distribution system, through permanent or temporary systems, depending on availability of materials.

In other substations substantial reconstruction work had taken place, but the substations were operating without proper protection equipment, owing to long delays in delivering the equipment.

In the Abadan/Khorramshahr region, it was reported that the maximum demand for electricity had decreased from 240 MW in 1979 to 100 MW in 1991; at one time, as a result of out-migration the demand for electricity fell even below 100 MW.

The Khuzestan Water and Power Authority reported that physical reconstruction of the distribution system damaged during the war was 30 per cent complete. The breakdown of this damage and reconstruction is set out in table F.3 below.

It was further stated that two thirds of this reconstruction had been carried out with materials diverted from development projects in other areas, with the result that other consumers had been deprived of power supplies. The mission was further informed that some 10 per cent of the power supplies had been reconstructed in a temporary manner only.

During the field visit the mission saw a total of eight substations, inspected the distribution networks in Abadan and Khorramshahr, and assessed the interconnecting systems between Bandar-e-Mahshar and Abadan, Abadan and Khorramshahr, Khorramshahr and Ahwaz. This visit confirmed that, while major efforts were being made to reconstruct this devastated area, a lot of work remained to be done, or needed to be redone as large areas had been reconstructed with emergency temporary supply systems.

Table F.3. Khuzestan distribution system

	Damaged		Reconstructed	Outstanding
Medium voltage lines	2 680	KM	800	1 880
Low voltage lines	1 855	KM	600	1 255
Underground cables	151	KM	0	151
Transformers destroyed	3 384		750	2 634
Consumers disconnected	85 586	KM		
Lighting	35 000	KM	3 500	31 500
Vehicles	80	KM	25	55

It was reported that electrical supply is unable to meet the demand in the area 200 times per year in this province and that at the same time total demand for electricity in the Khuzestan province increased by 75 per cent in the period 1980 to 1990, in particular, in the north and eastern areas, owing to a steady flow of returnees from the war zone. Per capita consumption of electricity in this area doubled during the war. As a result of the war, major system developments planned for the Abadan and Khorramshahr area were not implemented.

Kordestan, Ilam, Bakhtaran

The power system for these three provinces is under the control of the Gharb Regional Electrical Authority.

Gharb

The Ministry of Energy reported war damage and reconstruction in these provinces as set out below.

Several small diesel generating units with an overall capacity of 138 MW were destroyed in isolated networks in the region. These diesel units have

not been replaced but the power supplies to the region have been upgraded by installing transmission and distribution systems which connect these areas to the major interconnected transmission network. In addition, substantial damage was done to the distribution system in this area. The extent of this damage and reconstruction is set out in the table F.4.

Table F.4. Gharb distribution system

	Damaged	Reconstructed	Outstanding
Substations	894	512	382
Lines	3 176 km	1 800	1 376
Buildings	27 100 sq.m.	9 680	17 420
Street lamps	24 300	13 900	10 400
Consumers disconnected	48 400	24 000	24 400

Transmission system

The transmission system consists of 400 KV, 200 KV and 132 KV networks. The 400 KV network and the overall control of the operation of the network is carried out by Tavanir Power Generation and Transmission Company. The 230 KV and 132 KV networks are controlled by the regional electric companies. The total transmission system was subject to attack in the areas remote from the war region due to the capability to disrupt energy supplies required for the war effort by attacking this system. The substations on this system were the major targets for repeated attacks due to the capability to disrupt energy supplies by targeting strategic substations for attack. It was reported that most of the major substations were damaged during the war. This caused disruptions of the electricity supply to major cities. As a result of the attacks power had to be supplied on lower voltage networks, with resulting deterioration in the total power supply and voltage reductions in the affected areas. Subsequently, this led either to total failure to supply some areas or to occasional disruptions in the power supply. The major north/south electrical supply lines were linked at Arak, where the vital 2 x 400 KV transmission lines converged. This was reported to have been attacked three times during the war owing to its strategic importance; twice the resulting damage was severe, while one attack left behind minor damage. This substation was returned to service after each attack, but much of the repair work done is of a temporary nature.

In addition, five other 400 KV substations were reported to have suffered severe damage. The data provided indicates that approximately 50 per cent of the permanent reconstruction has been completed.

In the Khuzestan area 26 substations and 340 KM of the 230 KV and 132 KV transmission circuits suffered extensive damage and some of these were totally demolished. It was evident from the mission's visit to this area that in spite of the efforts that had been made to restore power supplies, substantial

reconstruction work remained to be done. Damaged material is in service in several areas to maintain supplies as all available spare materials have been used and replacement material is frequently delayed by up to two years from placement of order. The bulk of the transmission equipment required must be imported.

The regional power authorities mentioned that 50 per cent of the damage to the transmission system had been repaired during the war, but that 90 per cent of this was subsequently damaged again. Time required to complete reconstruction work was estimated at two years, but that completion would take longer as the equipment required had yet to be ordered because of financial constraints. The information provided by the Khuzestan Water and Power Authority showed that approximately 30 per cent of the reconstruction work on the transmission system in this area had been completed.

In the Garbh area, the Ministry of Energy reported that 11 substations and the transmission circuits suffered severe damage. The data provided indicate that reconstruction of the substations is approximately 50 per cent complete and that of the transmission circuits is 80 per cent complete.

Generating system

The generating system was subject to attack in areas remote from the war zone to disrupt the power supply systems. At first only the electrical transmission stations at the power stations were attacked, but subsequently the equipment inside the stations was severely damaged.

In meetings with the Tavanir Power Generation and Transmission Company, it was reported that six thermal power stations including Neka, in the north, on the Caspian Sea, Esfahan, in the east, Tabriz, Zargon and Ramine in the south all suffered severe damage during the war and that Neka was attacked three times causing a loss of production of 25 per cent of the output for over four-and-one-half years. It was reported that these power plants have all been returned to service, but in many cases only temporary repairs had been carried out, with resultant unreliability in operation.

In addition, the hydropower stations at Abbas Pour and Dez which were damaged by repeated attacks during the war have been restored to service using temporary measures, particularly in the electrical switchyard.

The Ministry of Energy reported that permanent reconstruction of the power plant is approximately 45 per cent complete.

Appendix

In the occupied provinces of Khuzestan and Gharb electrical systems, the peak power demands in 1980 and 1981 were 391 MW and 348 MW respectively. The peak demand in Tehran was 1,966 MW in 1981.

At that time the predicted power demand for 1987 and 1992 for each province was as illustrated below.

	1982 MW	1987 MW	1992 MW
Khuzestan	588	1 100	1 700
Gharb	348	950	1 585
Tehran	1 966	2 900	4 800
Esfahan	658	1 700	2 770
Azerbayjan	275	820	1 251
Fars	265	780	1 150
Gilan	248	459	695
Mazandaran	340	592	820
*Hormozgan	181	297	454
*Kerman	180	474	680
*Khorasan	298	730	1 112
*Sistan and Baluchestan	40	187	300

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* In 1982 these four provinces had isolated networks.

Hormozgen and Kerman have subsequently been connected to the main interconnected system.

G. TELECOMMUNICATIONS AND BROADCASTING

1. Telecommunications

Telecommunication services in the Islamic Republic of Iran are operated by the Telecommunication Company of Iran (TCI). Prior to the war the country had nearly 1 million telephones, whereas currently the number of working telephone lines is over 2.25 million, served by about 600 telephone exchanges interconnected by a network of about 60,000 analogue trunk circuits. The network is almost fully automatized and normal telecommunication services, including subscriber trunk dialling, telex, etc., are offered. The technology used is mainly analogue and electromechanical (some semi-electronic systems are also in use) and for this type of equipment both investment and operating costs are high. There are also difficulties in offering modern services, for example, detailed billing, and there is a clear need to change over to modern technology. A significant part of the plant is locally manufactured at Shiraz in government factories under the Ministry of Post and Telegraph. These factories are likely to change over to digital (electronic) technology in the near future. Studies for the Integrated Services Digital Network (ISDN) are also being conducted by TCI.

As stated in this report, the border telecommunications network was largely destroyed. A total of 50,000 telephone lines with associated buildings, switching equipment, microwave and open-wire carrier links was destroyed and in many cases the external plant network was destroyed or rendered unusable. In some cases the plant had been reconstructed and then was destroyed again. The installed cost of the damaged telecommunication has been estimated by the Government at approximately Rls 115,000 million. TCI, however, had to restore minimum service rapidly with locally produced equipment, and have achieved notable results in achieving their objectives. TCI has intimated that installations in 120 telecommunication centres were damaged or destroyed. A detailed list was furnished in June 1991, which was referred to in the first report. From this a list of towns with heavy damage has been constructed and is available in table G.1. This list includes 15 towns and 20 small centres. Out of the 15 towns, 9 were visited during the two survey missions. A further list of towns where light or medium damage was inflicted is available in table G.2.

Owing to the high priority given by the Government to telecommunication reconstruction, a substantial part of the destroyed assets have been replaced. In some cases, however, plants have not yet been restored to their full capacity, owing to the fact that the inhabitants have not returned to the areas concerned. It was also noted that service has been restored by using the earlier generation of equipment available from local factories and that these may have to be upgraded or replaced if an integrated network capable of providing modern services is to be built up. TCI submitted a reconstruction and development plan for the border areas (November 1991) which is separately available.

(a) Estimate of physical damages

Government estimates

TCI submitted a detailed report of damages sustained during the war. This was prepared in June 1991 and details damages to 120 centres in 20 provinces. The report indicates partial or heavy damage to 172 buildings, 9,000 kilometres of underground cable and 50,000 telephone lines with the associated network. The value of the damaged assets has been estimated by TCI at Rls 115,000 million. TCI, however, indicated that inflation to the extent of 62 per cent has been observed during the last three years and the above figure needs to be revised upwards.

Table G.1 lists the installations which were reported as heavily damaged. These affect 15 towns and cities and 20 villages. According to government estimate, a network of approximately 50,000 telephones was destroyed, including buildings, telephone exchanges, carrier and radio (microwave) equipment, underground cables, subscribers apparatus and vehicles. Table G.2 indicates 15 towns where light or occasionally medium damage was reported. In addition, there was a large number of villages where the telecommunication facilities were destroyed, but the value of these assets was small. Table G.3 indicates the progress in reconstruction works at the heavily damaged installations. This has been extracted from the reconstruction and development programme submitted to the mission separately (November 1991).

(b) Methodology of verification

The United Nations mission paid two visits to Iran in June and November 1991 and inspected 15 towns, including 9 of the heavily damaged ones listed in table G.1. In many cases, direct verification of damage was possible; in other cases, indirect evidence in the form of photographs and visible damage to buildings in the nearby neighbourhood was available. The physical quantity of assets damaged was verified against population estimates, type of activity and the assets which would normally have been installed in such cases. In some cases, the assets installed were in excess of immediate requirements but are not considered unusual as a forward planning procedure. The preliminary report (S/22863) may be referred to for a description of the damages in the southern sector.

(c) Observations in the northern sector

Bostan. Before the war, Bostan had a population of 8,000, and a telephone exchange of 200 lines with an open wire carrier system connecting it to the main trunk network. The town was occupied and destroyed along with the telecommunication system. A new building has been constructed, a 100-line exchange with a 12-channel carrier system has been commissioned and a 60-channel VHF radio system is being installed. It is understood that the town is being developed for 35,000 inhabitants taking into account the surrounding area. Reconstruction will therefore require additional telephone exchange capacity to be set up.

Dehloran. The pre-war population of Dehloran was 10,500 and a 500-line exchange with 12-channel carrier systems provided service. The town changed hands and the exchange was three times replaced and damaged. Currently, a 100-line exchange is operational, but a 1,000-line exchange with a microwave system will soon be commissioned.

Mehran. This was a town with 14,500 inhabitants with a 500-line telephone exchange and carrier/UHF systems. This was totally destroyed and reconstruction has started. At present, an interim 100-line exchange with a 24-channel UHF system has been installed. This will require substantial expansion when the town is fully developed.

Qasr-e-shirin. Prior to the conflict this town, located some 3 kilometres from the border, had a population of 28,000, and some 62,000 within the municipal area. The 1,000-line exchange that was in operation was completely destroyed. Reconstruction work has started and an interim installation of a 100-line exchange completed.

(d) Conclusions relating to damages

The damage observed could be classified in two categories: where enemy forces occupied the town, for example, Khorramshahr, Bostan, Mehran, Qasr-e-Shirin, the damage was total and explosives appear to have been used to destroy the plants. Towns in the vicinity of the occupation, such as Abadan and Dehloran, also suffered heavy damage as telecommunication targets were in range of ground artillery. The second category contains important cities beyond the immediate areas of ground fighting which were targeted during air attacks. Unfortunately, telecommunication towers are highly visible targets and the exchange and microwave installations could therefore be easily identified. However, targeted installations in the interior generally did not suffer serious damage, except the earth station complex at Asadabad which was heavily damaged.

Based on these observations, it is concluded that the physical estimates of damages presented to the mission by TCI are found to correspond to the lists submitted and that the border telecommunication network consisting of 50,000 telephone lines was almost totally destroyed. A part of the underground cable network could perhaps be recovered, but this would require considerable human effort in tracing the telephone conductors and reconnecting them.

(e) Estimate of financial damage

As mentioned, TCI have indicated that the direct financial loss amounts to approximately Rls 115,000 million. However, based on the type of network existing in the border region, it was felt that if modern technology is used for reconstruction and equipment procured in the international market at competitive prices, the cost per telephone line could be reduced. However, this line of action is not immediately available to Iran as they have to depend on the current manufacture from their own factories until these are modernized.

(f) Reconstruction effort

It is observed from the current status of reconstruction shown in table G.2 that the bulk of the reconstruction work relating to the restoration of primary services has been completed. A major installation at Khorramshahr and installations of underground cable networks and provision of telephone service as well as completion of some microwave works are the main items pending. Much of the external plant network and 15,000 telephone exchange lines out of the 50,000 lines destroyed are yet to be commissioned. These works have been carried out by TCI within its own resources, largely with products from the government factories. In some cases, however, interim installations have had to be resorted to until the population returns.

The reconstruction of towns including the provision of telecommunications services is being done to attract not only the original population but in some cases displaced persons from surrounding areas. This policy requires expansion and modernization of services. TCI therefore plans not only to reconstruct to original capacities, but to develop services further in accordance with their five-year plan, as well as to modernize services. The plan incorporates the reconstuction of damaged sites and equipment, and normal expansion that would have occurred in a peace-time scenario. In addition, a reconstruction-cum-development plan for the border areas was prepared and submitted to the mission. TCI mentioned that, taking into account the inflation and current prices, they have been allocated Rls 139,000 million to complete the plan at current prices. This would not be adequate to finance the total development plan for the border areas. Unfortunately, it was not possible to separate the reconstruction component from the total development plan as it is being implemented on an integrated basis using modern technology. TCI also indicated that up to now Rls 40,000 million have been used for reconstruction and this has been worked out by them to be equal to approximately Rls 47,000 million at current prices, taking inflation into account.

As far as the first five-year plan is concerned, TCI has indicated that it proposes to install approximately 450,000 lines in the 5 border provinces during the plan period. Part of this network will utilize modern digital technology and part will rely on the existing technology employed by the factories at Shiraz.

TCI has already undertaken a modernization plan and the Government proposes to change over the factory production to digital telephone exchanges and digital microwave links. Optical fibre links are also to be introduced. With these changes, new services and facilities can be introduced and demand for value added services, which can best be provided by the private sector, will increase. The border areas should also benefit from such advances as they have suffered considerably in the recent past. The reconstruction programme should keep all of this in view. Adequately skilled labour is reported to be availble for the reconstruction effort. However, exposure of engineers to new technologies available abroad should be encouraged.

It was understood from TCI that the present requirement of foreign currency was approximately $1,450 per telephone line. This may increase somewhat during the technology change-over period, but should decrease later on when the factories are operating at full capacity. Modernization of the factories seems to be an appropriate area for international assistance for reconstruction.

(g) Conclusions

In the telecommunications sector, two stages of reconstruction are envisaged. The first stage involves restoration to pre-war levels and physically about 35,000 out of the 50,000 lines damaged or destroyed have been completed. The second stage of reconstruction seeks to make up for the loss of normal development during the war years and this stage is expected to be completed by 1993. The expenditure on reconstruction has been Rls 40,000 million up to now and a further amount of Rls 139,000 million is expected to be allocated for the residual part of the first stage of reconstruction and the second stage. It is recommended that the second stage of reconstruction should be carried out to the extent possible with modern technology. Adequate training in new technologies should also be planned and organized.

2. Broadcasting

(a) General observations

The Islamic Republic of Iran Broadcasting (IRIB) is responsible for producing programmes and providing radio and television services to the country as well as for transmitting short-wave radio programmes to foreign countries.

Two radio programmes currently cover 95 and 80 per cent of the population and two television programmes can be received by 85 and 65 per cent, respectively. The two radio and television programmes are produced in Tehran. However, local contributions are produced by 24 local radio and television centres and incorporated into the second programmes.

Considering that a significant percentage of the population is illiterate, the Government relies on the broadcast media to disseminate a wide variety of cultural, educational, agricultural and health care programmes. IRIB receives, therefore, strong support from the Government.

The overall damage assessment by the mission during visits to the damaged sites confirmed the results of the first mission. Only one medium-wave radio station had been omitted, namely Gilan-e-Gharb. From the visits, the conclusion can be drawn that the IRIB is technically capable of coping with its reconstruction task.

(b) Estimate of damages

In the western provinces 10 high-power medium-wave transmitters between 50 and 600 kW and 2 provisional 10- and 20-kW transmitters were destroyed, as well as 7 130-m antennas and 8 diesel generators ranging from 800 to 1,200 kW.

In addition 14 10-kW FM radio transmitters and 22 television transmitters between 2 and 40 kW were destroyed or disappeared during the occupation. Four 10-kW FM transmitters and five 10- or 40-kW transmitters were also damaged. The corresponding 8 towers (44 to 220 metres), including antennas, were demolished as well as 11 diesel generators from 50 to 300 kW.

Two television studios and 5 radio studios were completely destroyed, including the equipment. The demolished buildings have a total surface of 20,000 square metres. Table G.4 provides details on destroyed or damaged stations.

Antennas at the Kamal Abad short-wave station were damaged. This station sends programmes to foreign countries. The Gilan-e-Gharb medium-wave station was of a provisional nature to replace the destroyed Qasr-e-Shirin station. This station will, however, not be reconstructed.

IRIB estimates that the reconstruction costs for the entire broadcasting sector will amount to Rls 19,000 million, of which $118 million are in foreign exchange.

(c) Reconstruction and development

As witnessed during the visits to the sites, IRIB proved to be very active in reconstructing the destroyed stations. In some cases, where the same type of transmitters is no longer available, more powerful transmitters are being used instead. To reduce the risk of damages by bombing or shelling, the transmitter stations are rebuilt in thick concrete shelters and covered with earth. As a result, therefore, building costs are significantly higher compared to previous years. Table G.4 also provides information on the status of completed work and the timetable of reconstruction for the stations that so far have not been rebuilt. The table shows that a significant part of them is still under reconstruction. Owing to the increased number of projects simultaneously implemented and serious manpower shortages, especially the lack of skilled engineers, severe difficulties causing critical implementation delays are encountered in commissioning some transmit stations. IRIB, in some cases, has to call on the services of the equipment supplier for implementation, work which frequently proves to be very costly.

For future projects, the mission is of the view that the installation and commissioning should be part of the delivery contract, especially if domestic capability is limited or unavailable within IRIB. When these components are included in a project from the very beginning, they are being submitted for competition to interested bidders and will compose a small part of the total delivery and therefore offered at costs representing only a small percentage of the total value of the contract.

(d) Validity of estimates

The financial estimates for the reconstruction of war damage have been roughly verified for the equipment on a station-by-station basis. The figures provided to the mission by IRIB seem to be somewhat high compared to the usual market costs. However, considering the difficult conditions prevailing in the country during and after the war, these figures as well as the total estimated costs for reconstruction are credible.

(e) Government priorities and five-year plan

The current sectoral five-year plan (1988-1992) has as objectives to expand the television coverage to 95 per cent and 85 per cent of the population for the first and second programmes, respectively. For both first and second radio programmes, the coverage is aimed at reaching the entire population by the end of 1992.

(f) Status of plan implementation

No overall reconstruction plan seems to have been developed. Damaged stations are reconstructed as quickly as possible. Table G.4 provides details on the level of completion, the equipment and the foreseen year of future operations. All stations should be fully operational by the end of 1993. At present, approximately 50 per cent of the equipment is reinstalled, but only 30 per cent of the stations are in operation. However, most of the remaining equipment is already on order or has been delivered.

(g) Implementation capability and required assistance

Technical level

IRIB's personnel is adequately trained to carry out reconstruction work of the war-damaged equipment; further, it is capable of developing and operating the broadcasting network with the exception of the commissioning of certain transmit systems, as explained above.

IRIB would need some inputs of technical assistance in these areas. However, owing to the high specialization of the work required, recruitment of international experts other than employees of equipment suppliers might be difficult.

(h) Conclusions

The only difficulty is experienced in the installation and commissioning of high-power transmitters. In certain projects currently being implemented, technical assistance could be requested to address this problem and improve for the longer term the domestic skill level. For future projects, a change in the project design may be proposed. The reconstruction costs are estimated at Rls 19,000 million and the reconstruction work is believed to be half completed. IRIB has not mentioned the need for any direct assistance as their funding is from government budgets. The Government may, however, require financial assistance for the reconstruction of the sector.

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Table G.1. List of heavily damaged telecommunications installations

Code: B-Buildings MW-Microwave E-Exchange C-Cable Network
O-Other Plant UHF-Ultra high frequency radio

Location		Damaged Installation	Exchange Size	Remarks
KHOZESTAN				
1.	Khorramshahr	B/MW/E/C	10,000	Total destruction
		Storeyard		Total
2.	Abadan	B/MW/E/C	13,000	Total
		Trunk centre	800	Total
3.	Dezful	B/MW/E/C	10,000	Heavy
		Trunk centre	1,000	Total
4.	Susan Guerd	B/E/C	300	Heavy
5.	Bostan	B/E/O	200	Total
6.	Small towns (4)	B/E/MW/O		Total
ILAM				
7.	Dehloran	B/E/O	1,000	Total destruction
8.	Mehran	B/E/C/O	500	Total
BAKHTARAN				
9.	Qasr-e-Shirin	B/E/O	1,000	Total destruction
10.	Zarpol-e Zahab	E/C	400	Total
11.	Gilan-Gharb	E/O	100	Total
12.	Small offices (12)	O		Total
KORDESTAN				
13.	Baneh	B		Heavy destruction
14.	Marivan	E/C/O	500	Total
15.	Sanandaz	B/O		Heavy destruction
16.	Miandoab	E/B	10,000	Total
	Trunk centre	E	1,200	
HAMADAN				
17.	Asadabad	Earth station	Ant 1/2	Total
TOTAL LINES DESTROYED		50,000 Local	3,000 Trunk	

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TELECOMMUNICATIONS

Table G.2. List of towns with light or medium damage

	Location	Damaged Installation
1.	Ahwaz	Buildings, cable network
2.	Ilam	Buildings, cable, trunks
3.	Islamabad	Buildings, microwave, exchange, cables
4.	Bakhtaran	Building, carrier equipment, cable
5.	Nehavand	Buildings, cables
6.	Khoramabad	Building, exchange (10,000)
7.	Lorestan 5 small centres	Building, exchanges (6,500)
8.	Shahrekord	Buildings, carrier
9.	Zanjan	Cables
10.	Kharg	Buildings, cables
11.	Arak	Cables
12.	Shiraz	Cables
13.	Hamadan	Cables
14.	Bushehr (Kharg)	Cables
15.	Tehran	Building

Note: In addition, there were a large number of villages where telecommunication facilities were destroyed.